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CHEMICAL & METALLURGICAL ENGINEERING

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Fertilizer Industry at The Crossroads of Progress

ELSEWHERE in this issue we publish abstracts from the presidential address of Gustavus Ober, Jr., at the annual meeting of the National Fertilizer Association. It is straightforward, courageous and constructive. It contains a message that every industry and every manufacturing unit would do well to heed.

It is no secret that the fertilizer industry has been in the doldrums. Some substantial companies are in the hands of receivers. All have felt the rub. Why? It is true that the farmer has had little money to spend on fertilizer, yet the consumption in 1923 was almost as large as in 1918 and 1919, both of which were considered years of large consumption. Why, then, should 1923 have been so disastrous? It was a case of hysteria within the industry. The minority, driven by expediency, reduced prices and precipitated the landslide of cut-throat price cutting that has brought the industry face to face with ruin. This keen analysis by one of the industry's leaders was followed by an outline of a corrective program designed to pull the industry out of its mire of hard times.

The program is simple: First, be good business men, and second, increase the market for fertilizer. The carrying out of the program will require foresight, but once under way, it should prove effective and reasonably simple. A committee of active members will be appointed to formulate a code of principles to which each member of the association will be asked to subscribe. This should make it certain that a majority of the industry will not stampede it to unbusinesslike practices. Add to this the stabilizing effect of the brilliant report of the cost-accounting committee. This makes it possible for each manufacturer to know his production cost so that he will not sell below cost without realizing it. The industry is then in a position to advance with confidence.

But more is required. The stimulus of doing a big job together in order better to forget the petty grievances of the past is badly needed. Therefore let that big job be one of increasing the market for the products of the industry. This is the work of the soil improvement committee, enlarged and expanded appropriately to achieve great results. The farmer must be sold on the idea of more fertilizer. The fundamental economies of the problem have been proved beyond a question. Tremendous markets are in prospect if this work is done intelligently, and it should be remembered that an increasing demand is the only sure cure for a sick industry.

That is the program presented by President Ober. Have the men of the industry courage enough to follow that leadership to success or will they spinelessly chase the wraith of expediency to inevitable ruin? This is the time for a turning point in the fertilizer industry. It has courageous leadership and a constructive program. The eyes of the industrial world are focused on it and it will be judged by results. It is a game of follow the leader, on the one hand to success and prosperity and on the other hand, if the men of the industry lack courage and follow the ubiquitous price cutter, to bankruptcy and ruin.

The Livest Group of Scientific Men in the World

THE second National Colloid Symposium was a great success. The report published elsewhere in this issue attests to the enthusiasm of those attending and to the real achievement brought out in the papers and discussion. One is tempted to ask why. Why should such a meeting backed by no organization bring 300 people from industry and university to an animated conclave? Why should professor and industrialist sit together through hours of papers and discussion? Of course colloids is a timely subject and really notable progress is being made in both fundamental theory and industrial application. It would be easier to find a group interested in colloids than in, say, halogenation.

More important than the general subject is the method of handling the program. At the invitation of the committee on colloids of the National Research Council, distinguished scientists discussed their specialties. There was plan and co-ordination in the program. There was a unique sense of balance and proportion in the plan. Eighteen papers and three demonstrations of industrial equipment, spread out over 18 hours of meeting, gave ample time for full discussion. How long will it be before all organizations and groups appreciate the wisdom of this action? How long shall we be compelled to suffer a plethora of half-baked papers at scientific meetings with no time to discuss really important papers?

To return to the meeting at Evanston, there were many high spots. A new method of classifying adsorption phenomena, a new explanation of emulsions without protective colloids, new methods of measuring particle size and other colloid phenomena, new approaches to colloid problems—all these things were presented. They are new tools for the further study of this magnificent field.

Still another perspective of the meeting presents itself. There is in prospect a National Institute of Colloid Chemistry. It is seeking endowment. No group of workers could have given more substantial guarantee of the success of such an institute than these colloid men in their second annual meeting. With such enthusiasm, such achievements, such live men, the National Institute of Colloid Chemistry should become a vital, inspiring reality. May this meeting speed the day of its establishment!

A Cross-Section of The Engineering Profession

WHAT proportion of engineering graduates desert the profession for other fields of activity? How many combine their engineering work with executive and managerial responsibility? How many confine their attention solely to the practice of engineering—design, construction, operation and testing? What is an average beginner's salary for the engineer and how much may he logically expect to find in his pay envelope after 5, 8 or 25 years?

These questions have been answered for one representative institution as the result of a questionnaire sent to Penn State engineering graduates by Dean R. L. Sackett. More than 700, or approximately 30 per cent, of the 2,400 graduates of the School of Engineering supplied information regarding their experience since leaving college, their present functions and the salaries received at various periods since graduation. To some it will be surprising to find that of the 737 graduates only 39, or 5.3 per cent, had drifted into non-engineering lines. It is obviously unsafe to apply this percentage to all of the institution's graduates, however, for it is among the 1,700 graduates who did not reply to the questionnaire that one would naturally expect to find the greater proportion of those who had fallen from the ranks of the engineers. In any event the proportion is doubtless far less than the 50 per cent ratio often referred to in educational and industrial circles.

The functional study of the present work of these graduates is an interesting commentary on engineering training. On a percentage basis administration claimed 29; construction and operation, 26; design, 15; sales, 13; while the remaining 17 per cent was about equally divided among research, testing, consulting, teaching and non-engineering work. Another classification designed to show the number engaged in engineering practice that involved a minimum of executive responsibility revealed a figure of 48 per cent, as compared with 27 per cent for the distinctly managerial positions. It is only fair to point out in connection with the latter classification, however, that the average number of years out of college of those answering the questionnaire was only seven. This was due principally, of course, to the larger classes graduated during recent years.

Since salary continues to be the yardstick with which the industrial world measures the value of engineering service, it is interesting to compare the pecuniary attainments of this group of engineers. Of those in their first year out of college, 108 reported average salaries of $1,600 per year during 1922 and 1923. Of the fifth year men 88 were averaging $3,110 in 1922-3. By the eighth year this figure had increased to $4,710 for the 143 reporting. Forty-six in the seventeenth year were receiving an average of $6,840, in the twenty-second year 15 were averaging $7,000 and for the twenty-fifth year 27 reported an average salary of $9,200. Beginner's salaries have changed considerably between the graduating classes of 1898 and 1923. The cubs of the former year received $600 as compared with $1,015 for those who graduated during the period 1913-15 and $1,600 for the 1922 and 1923 classes.

These facts are of value not only as an index of the effectiveness of the engineering courses of Pennsylvania State College, but actually they represent an interesting cross-section of the engineering profession. Their portrayal of the economic status of members of the profession may or may not coincide with the average from other colleges located in other sections of the country. They do indicate, however, a closely knit profession, spreading over a wide range of service and responsibility, and in return receiving compensation comparing not too favorably with the trades and other professions.

Electrochemistry and the Manufacture of Gold Leaf

IN AT least one industry the frugality of early times has persisted. In fact, it would be difficult to find an instance entirely parallel to the economy of raw material evidenced in the manufacture and use of gold leaf. By customary hand-beating methods, one grain of gold alloy is made to cover about 40 sq.in.; and the cost to the ultimate consumer is such that the producer of the metal receives for the raw material used only an insignificent proportion of the price paid for the beaten product. The cost of the lengthy manipulation needed is almost the entire cost of the finished leaf—the value of the gold used is almost negligible. Hence it would seem that considerable opportunity has existed for inventiveness to displace a method of preparation that has persisted for 3,000 years or so. Any alternative scheme would have to be extremely costly if it failed to supersede hand beating on the score of operating expense. To date most of the attempts to cheapen production have centered around efforts to utilize mechanical means to effect the "spreading" of the gold. For the most part these have failed because of the heat generated and the consequent damage to the costly skins used to interleave the gold during the beating process.

More recently, however, an ingenious method of manufacturing gold leaf has been patented by R. T. Leighton and F. Demel, who have utilized the principle of electrolytic deposition from an aurocyanide solution. Two revolving drums are used to carry a long ribbon of thin silver, which dips into an electrolytic bath placed between them. The drums are revolved at a speed regulated to insure a deposit of a film of gold of the required thickness, and the silver ribbon is treated so that this occurs on one side only. In the next stage of the process the gold-plated ribbon (the gold being uppermost) is laid on and carried by a celluloid band, which dips into a bath of nitric acid in such a way that the metal ribbon floats on, and the celluloid band dips below, the surface of the liquid. The silver is dissolved, and the gold film again meets the celluloid band as it emerges from the bath and is carried forward on it to a vessel containing water, the gold floating on the surface as in the dissolving stage and again passing onto the celluloid band as the latter emerges from the water. Subsequent treatment includes washing in alcohol and drying on a carbon conveyor. The final product is then blown by hot air onto the usual protective paper.

The silver used, of course, is easily recoverable. The success of the process would appear to depend on a recognition of the delicacy of mechanical adjustment and the precise maintenance of predetermined conditions in the electrolytic bath. It is improbable that the resultant leaf would posses the polished appearance

of the hand-beaten product, and it is evident that difficulty would be experienced in producing a leaf containing sufficient copper to insure the rich color usually desired. But these disadvantages might well be counterbalanced by lower production costs. Whatever the ultimate success, technical or commercial, of the new process, it is interesting to note that science may solve the problem of the cheap production of gold leaf. Hand-beating methods that have persisted for thousands of years are likely to be displaced by the application of mechanical ingenuity, coupled with the utilization of well-known electrochemical principles.

A Notable Achievement

AT THE recent annual meeting of Brunner, Mond & Co., Roscoe Brunner recounted the commercial results of some remarkable work on the nitrogen fixation process. His bare statement that since Dec. 25, 1923, the Billingham plant of the company's subsidiary, Synthetic Ammonia & Nitrate, Ltd., has been producing ammonium sulphate at the rate of 100 to 120 tons per day is significant—as much for what it says as for the interesting story it leaves untold. Later the technologist must bring to light the stupendous amount of chemical and engineering research that made this achievement possible, and also point out the many serious obstacles of construction and operation that were met and conquered before successful production was attained. Some of the latter problems required the development of special engineering technique. Consider, for a single example, the design and manufacture of valves operating against pressures of 3,000 lb. per sq.in. at temperatures well over 500 deg. C. When details such as these are at last available new chapters will be added to our chemical engineering manuals.

Those who have followed the progress of the British efforts will recall the inception of Brunner-Mond's work during the war and the development of the modified Haber process that led to the construction during 1921 of the 2 to 3 ton experimental plant at Runcorn in the works of the Castner-Kellner Alkali Co. The erection of the large plant at Billingham was a logical step in a program which, according to Mr. Brunner, calls for an almost immediate doubling of output with the possibility of trebling the capacity in the near future. Provision has already been made for adequate buildings, equipment and ground. The members of the technical staff, many of whom were connected with the work from its very beginning, have accumulated an experience comparable only with that of the chemists and engineers responsible for operations at Oppau and Merseburg.

Technical descriptions of the Brunner-Mond plant and process which have so far reached this country have been meager and fragmentary. *Chemical Age* (London) reports that representatives who have visited the works at Billingham have been impressed by the great predominance of automatic control. "The operations—flow of materials, temperature, pressures, and so on—are all, as far as possible, controlled automatically, the whole plant being designed on the most modern lines." In the *Times* (London) of June 6 appeared a long popular description of the plant, which incidentally mentions several notable improvements upon German practice in nitrogen fixation. It is reported, for example, that the converters in which the actual synthesis takes place are so arranged as to be kept at or below the boiling point of water, thus adding greatly to the safety of the process as well as improving the lasting qualities of the materials of construction. The same newspaper account describes the use of ground anhydrite (calcium sulphate) and CO_2 as a substitute for the sulphuric acid ordinarily used in the ammonium sulphate process. This method, effectively carried out during the war in Germany, where pyrites was at a premium, is regarded by most chemical engineers as of doubtful value, especially in normal competition with sulphuric acid. This phase of the British process will be watched, therefore, with unusual interest in this country as well as in England.

Aside from the technical details and the purely human experiences that are yet to be described, the announcement is one of notable significance in chemical engineering history. Such achievements are truly milestones in the progress of civilization.

Giant or Super, What's the Odds?

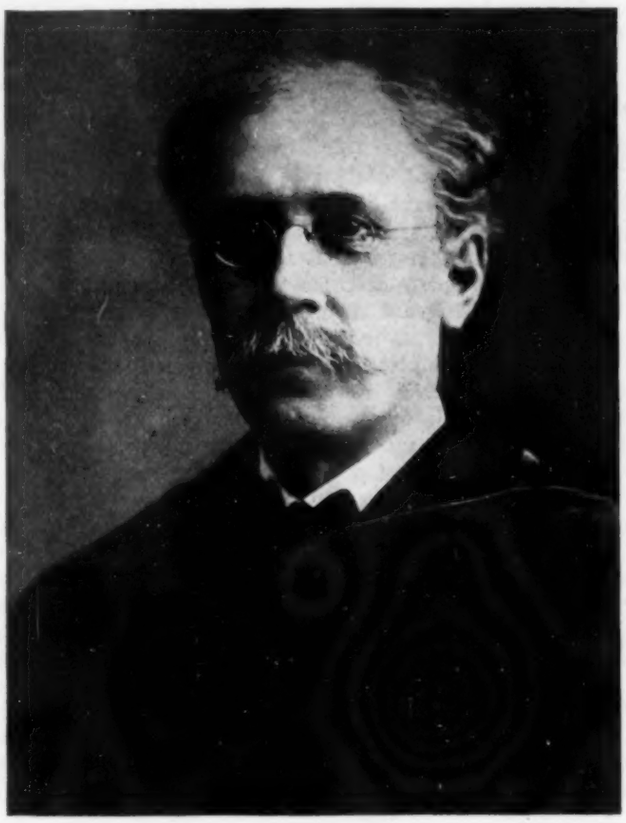
SOME weeks ago an editorial appeared in these columns commending the carbonization of coal at the mine mouth and the conversion of the fuel oil and gas at that point into electrical energy, as part of the superpower scheme. Since then several of our friends in the power plant field have taken us to task, saying that what we were talking about was "giant" rather than "super" power.

Maybe we were. But what's the odds? Because one man put a plan before the country as giant power and another put one out as superpower makes no difference. What the country understands by both is a plan to link together all the economic means of power generation in such a way that a steady, efficiently generated supply of electrical energy may be everywhere available. There are undoubtedly differences in the details of the two plans; but the ultimate object of each is identically the same.

And by whatever name our good friends choose to call the scheme, we believe that the phase of it that we advocated is worthy of the utmost consideration. Let it be again reiterated, to transport raw bituminous coal is an economic crime. Also, to burn bituminous raw coal is an even greater economic crime. For when this is done, potential resources of invaluable chemicals —coal-tar derivatives, benzol, motor fuel and so on— go up in smoke, an irreplaceable loss. Is it not better, even at the cost of a severe wrench to established courses of action and trains of thought, to carbonize this coal at the mine and recover these values? Suppose the combined gas and oil engine power plants that could be established as a result of such carbonization were in units smaller than our steam-electric engineers are wont to think of. They would still be highly efficient. And, connected into a network transmission system, electric energy would be available to the public in at least as great quantities and at least as reasonable a cost. Again let us emphasize, it is time that power plant interest and the chemical engineering industries start co-operating, before the wasteful haulage and burning of raw coal be fixed upon the country for all time by the great investments in steam-electric plants that are at present contemplated.

A Teacher Distinguished as a Pioneer

Dr. C. M. Knight, a Rare Combination of Distinction and Length of Service, Honored by His Students



Charles Mellen Knight

RECENTLY the Erie Railroad offered a prize for the commuter who had traveled on the Erie for the longest time. If memory is reliable, there were many that had suffered for more than 50 years. This is the *reductio ad absurdum* of length of service. It is not in itself dishonorable to have done one thing for a long time, but it may indicate stupidity and certainly does not of necessity redound to one's credit.

Credit and honor rather to those that do things with distinction than to those that have only served long years. When, however, the two tributaries flow together into a majestic stream combining distinction with length of service, then time adds an especial dignity.

Less than a fortnight ago one of these occasions was celebrated. A number of distinguished chemists and engineers gathered to honor their former teacher. Fifty years ago Charles M. Knight was selected as professor of natural science at Buchtel College, in Akron. He had graduated from Tufts College and pursued graduate studies at Harvard and Massachusetts Tech. For 37 years he was an active teacher, first of science, then of chemistry. An associate of the early pioneers of the rubber industry and for many years a friend of Goodrich, he is a much beloved dean of the chemists of the capital city of rubber.

We can, if we like, disregard entirely his personal contributions to the great industry, notable though they are, and pay our homage solely to the great teacher. J. W. Thomas, works superintendent and vice-president of Firestone; Charles Jahant, general superintendent of the General Tire & Rubber Co.; Prof. J. H. James, of the department of chemical engineering at Carnegie Institute of Technology, and Dr. Floyd Metzger, of the Air Reduction Co., are some of his distinguished pupils who gathered together at his fiftieth reunion to wish him health and happiness.

The Knight Chemical Laboratory at the University of Akron (formerly Buchtel College) is a monument to the affectionate service that has made Dr. Knight a memorable figure, an outward sign of the profound influence he has had on his environment.

The Future of the Fertilizer Industry

Abstracts From the Addresses of Gustavus Ober, Jr., President of the National Fertilizer Association, and Others at the Recent Convention

A YEAR AGO the National Fertilizer Association convened and listened with enthusiasm and respect to a vigorous condemnation of commercial practices by President Ober. The business of selling at any price merely to keep the factory going at maximum capacity was called silly, wasteful and demoralizing. Everyone seemed to concur in the opinion and went home to do better.

On June 12 President Ober again addressed the association, assembled for the 1924 convention. His remarks are worth hearing, for they reveal the unhealthiness of the industry, they analyze reasons for the lack of health and they present constructive remedies for the present condition.

"It has been a year of disaster, demoralization and disappointment. With the best prospect for increased consumption of fertilizer we have seen hopes of a good year fade and disappear.

"Actually the consumption of fertilizer has increased, irregularly to be sure, but none the less decidedly. Yet we have through internal troubles taken no advantage of it. We have had overproduction and yet no one has been willing to accept less business than he considered himself entitled to. This is, of course, 100 per cent of his best year.

"Let us honestly face the facts, distressing as they may be. We have an industry that is basic and fundamental. Yet, with this tremendous advantage over some other industries, we are unwilling to shape our business to take proper advantage of it. There has been more useless talk in the past year than I have ever heard in my experience with the fertilizer industry. It seems to me that the time for mere talk is past and unless we are willing to act, disaster is not far off.

"When we saw our competitors do things that we knew were unsound, we felt justified in doing the same. We have been willing to let the minority lead us along disastrous paths, and until we show sufficient backbone and courage to act in the way we know to be right, we shall not be able to reinstate the industry. We shall always find that a percentage, however small, is willing, for the sake of expediency, to furnish unfair competition. We might as well recognize this, and rather than let it unsettle us, it should confirm and strengthen us in our efforts to do what in the long run is bound to prove advantageous.

"With a steadily increasing consumption, we should be approaching better times, and we have every reason to believe that consumption will go forward with a normal annual increase rather than go back. Given this fundamental help, we should be able to put our house in order so as to reinstate ourselves and our industry.

"The period of depression since the war has caused us much suffering. We were, of course, subject to certain losses during deflation that were unavoidable but we have had losses that were avoidable. One of the most distressing results of this period has been the sacrifice of so many of our principles of business conduct. The personnel of the fertilizer industry is as good as any in the country, but due to the trying conditions through which we have been passing, the ethics of our business relationships have suffered sadly.

"I feel this so strongly that I make the recommendation that a committee from the active members of the association be either appointed or elected to consider the formation of a simple code of business ethics and that when this code is accepted and approved by the association, each member should subscribe to and be held responsible for the general principles enunciated and that the committee on this code should have the right to call to the attention of any member violating its principles the fact that he has not conformed to the principles that govern the association.

"There has been more useless talk in the past year than I have ever heard in my experience with the fertilizer industry. Unless we are willing to act disaster is not far off."

". . . to consider the formation of a simple code of business ethics to which each member should subscribe and for the general principles of which he shall be held accountable."

"We are faced with overproduction and talk glibly of curtailment as a cure. The answer can be found as readily in creating a bigger demand for our product, and this answer will produce a healthier condition in the industry."

"The burden of my message so far has centered chiefly around the internal correctives necessary to make our industry clean, healthy and strong. Such a program, however, covers only half the field. It is the introspective side of our work. What we need even more is a vision of external accomplishments, a battle in which we can all engage as a unit, an enterprise in which common interest will make us forget petty troubles. History has shown us time and again that a militant body, whether political, social, religious or industrial, is a healthy, progressive body in which internal dissension finds small room.

"I believe we have only one answer, and that is in the work of the soil improvement committee, extended to far greater limits than we have heretofore dreamed, and conducted in such an extensive way that it will require the services not only of the committee itself but of every man occupying an executive position within the industry.

"But before you decide on the wisdom of such a venture, let me suggest one other important consideration to your mind. It is a physiological law that the body, when denied outside nourishment, will feed upon itself. It is also true that this same law applies to every realm of life, whether political, social, religious or physical. It is this same law that rules in a

crippled industry as well as a beleagured city, with the same terrible consequences. It is also the same law which causes me to seek your agencies rather than develop new fields or make my own existing agencies stronger and better.

"We say we are faced with overproduction and talk glibly of curtailment as a cure, because it seems to be the line of least effort. The answer can be found just as readily in developing a bigger demand for our product, and this answer will produce a healthier condition and bring much more glory to all than curtailment. Curtailment is a quick solution, but increase in consumption is the only permanent remedy. Bigger demand, however, is a slow growth, and because of our American spirit of wanting immediate results we lay it aside for the time being, although this, as a matter of fact, is the reason why delays should not be permitted.

"Many other reasons for enlarging the scope of this work will occur to you. I mention these two because they appeal to me as the most important. Let me repeat them.

"First, our internal dissensions can be greatly alleviated by outside interests and work. If we are bent upon conquest, let it be the conquest of new fields instead of one another.

"Second, to my mind, it presents the only permanent answer to overproduction, with the hope of a healthy growth.

"I am firmly convinced that if the members of the industry will set in order their own houses, stick to business principles, refuse, regardless of the action of their competitors, to act along other than sound economic lines in the distribution of their goods and will also present a united front and by aggressive action, such as outlined above, show their determination to increase the consumption of fertilizer by increasing the demand for their goods where at present there is no demand, the industry will once again enjoy prosperity and we shall have the satisfaction of doing business along progressive lines that will insure prosperity."

Gustavus Ober, Jr.
President of the American Fertilizer Association

What Does It Cost to Mix Fertilizer?

Following President Ober's address two significant committee reports were presented. B. A. McKinney, chairman of the cost-accounting committee, presented as his report a pamphlet called "Cost Accounting and Cost Estimating for Dry Mixers of Fertilizers." The booklet represents an enormous expenditure of effort and is substantially a handbook on how to construct and keep books. Each account is analyzed and described. Each entry is discussed in detail. It is a simple, lucid exposition of the technique involved. It will be of great service to the industry, for it will be possible now for small fertilizer mixers to keep track of costs. The result will be a great stabilization of the industry. No one is going to sell for less than cost if he knows what his costs are. The difficulty in the past has been that many fertilizer mixers merely added up the cost of ingredients, and added as much as they could for profit. This might be 20 per cent or zero or 100 per cent. They neglected entirely such items as interest on capital invested, depreciation, even sales expense and overhead. The result was a chaotic condition in which prices would toboggan without warning and in which the manufacturer that studied costs found his less business-like neighbor quoting suicidal prices. This report will inevitably tend to stabilize the industry. The committee's work is to be extended to acid phosphate production next.

The report of the soil improvement committee was read by its chairman, W. D. Hurd. It was more than a report of activity; it was a challenge to accomplish great things for the farmer by education. During the past year an epoch-making advance has been made in the quantitative application of fertilizer. Now it is possible to make a much more accurate estimate of the results that fertilizer will achieve. Think of this in terms of the average farmer. If he can be told how to make this estimate, how to fertilize to advantage, what fertilizer mixture to use, he will get more return for a given effort, a given acreage, a given capital. That is the program of the soil improvement committee. Help the farmer to become intelligent in the application of fertilizer. Clear up the underbrush and the deadwood so that the farmer can calculate his returns. Put the producer of foodstuffs on a sound industrial basis. Dr. Hurd's plea for support was inspiring, for he painted a picture of service and usefulness for the fertilizer industry that would not only bring its own financial return but would galvanize the industry with a new spirit of co-operation.

Other papers were presented. One by Dr. W. J. Spillman has already been referred to in connection with the quantitative yields from continued application of fertilizer. It is a new principle and means that, if a given quantity of fertilizer was applied and yielded 70 per cent increased return, a second like quantity would have produced 70 per cent of the original increase and so on. Finally V. H. Kadish, of the Milwaukee Sewerage Commission, told of a new source of organic nitrogen for fertilizer—namely, activated sludge.

Vinegar and Cider Plant of Jones Bros. & Co. at Watsonville, Calif.

Chemical Engineering in Vinegar Manufacture

California apples make the best vinegar. Abundant sunshine is responsible for an abnormally high sugar content, and this in turn produces a maximum quantity of acetic acid. Grade is determined by the number of grains of potassium bicarbonate needed to neutralize 1 oz. of the vinegar. The product from the plant to be described reaches the 65-grain standard, which is considerably higher than the average. Close technical control of the mechanical processing of the raw material and the fermentation and generation of the juice are features of operation.

ONE of the largest cider vinegar plants in the world is in the center of the fruit district of Watsonville, Calif., and is operated by Jones Bros. & Co. The raw material is sent to the vinegar plant in metal-lined wagons, to be dumped into concrete bins, from which the stock, as it is called, is conveyed by chain and bucket elevator to the disintegrating mills, known as graters, on the floor above the presses. The graters used in the Watsonville plant are of the Mount Gilead type, each with a capacity of about 500 bu. per hour. A drum, revolving at about 2,000 r.p.m., is equipped with twelve knives, set longitudinally. Adjustment is made by setscrews in the drum heads, one above and one below each end of each knife. The concaves, forming the stationary members of the grater, are adjustable as to distance from the knives, and are held in position by springs, which permit the passage of small stones without injury to the machine. In adjusting the grater, the concaves are set as close as possible to the knives without permitting contact during revolution of the drum.

The pomace from the graters passes, through a chute, to the press platform, where it is distributed to six Mount Gilead and two Dunning & Boschert juice presses. Current practice is as follows: On the platform a rack, or wooden grating, is placed, then a form, 3½ in. deep, to take the cloth. The space inside the rack is then filled with pulp, which is leveled roughly and covered with the sides and ends of the cloth. The form is then removed and a second rack is placed on top, the cycle of operations being repeated until eight or ten racks have been used, to form one "cheese."

The D. & B. presses are of the screw type, the racks being 62 in. square and the cloths 96x126 in. The Mount Gilead presses are operated by hydraulic ram, forming a cheese 55 in. square and 54 in. high. What is known as the transfer car system is used, in which a short track press is arranged, and the loading stand is separate from the press. The grater and pomace chute are mounted on the loading stand, the cheese being built up in the manner described. The loaded truck is then moved to the press by means of a transfer car.

The cheese from the first pressing is removed from the cloth, passes through a Mount Gilead picker and is elevated to a bin, from which it is drawn for repressing. The product from two primary cheeses makes one secondary cheese, the same machine being used for each operation. Other advantages of the transfer-car system include: (1) The centralization of loading and inevitable splashing; (2) less floor space, and (3) the centralization of the stripping of the cheese at one point. The stripping stands are placed near the loading stands, to obviate undue handling of the racks and cloths.

The picker used to disintegrate the cakes from the first pressing is a high-speed machine running at about 1,200 r.p.m. It consists essentially of a main rotating element, the drum, 24 in. long and 12½ in. diameter, equipped with forty spikes that project 1⅛ in. These engage with other spikes that project from the concave, which is held in position by spring pressure.

Hydraulic power for each of the Mount Gilead presses is furnished by a four-plunger pump, with high-, medium- and low-pressure cylinders. The diameters of the pump plungers are inversely proportional to the maximum pressure developed at each stage of the pressing operations. The delivery pipe, from a sump that forms part of the pump structure, communicates direct to the cylinders. The ram is directly underneath the pressure platen, on which are mounted ten 7-in. I-beams, to support the pomace truck. The pump operates the press at maximum closing speed during the initial stages of the cycle. Speed is thereafter reduced according to the pressure developed, thus preventing the escape of the juice without danger of damaging the cloths. Knock-out valves are a part of the mechanism, by which the check valves of each cylinder in turn are held open as the pressure rises.

The pomace from the second pressing is disintegrated and is then conveyed to a steam-heated Louisville rotary drier, in which the temperature is maintained at about 180 deg. F. The dried pomace commands a good price for jelly making and for the manufacture of pectin. The drier in use, extensively adopted for similar work elsewhere, consists of a cylindrical shell equipped with steam boiler tubes arranged adjacent to and concentric with the shell. Steam enters through a head casting, provided with a return manifold for condensed water. At the other end the tubes are free to expand or contract but are held in position by a flue head. The wet pomace is fed into the flue-head end of the shell, which is provided with a screw conveyor and vapor outlet, drying being effected by the counter-current movement of hot air and pomace, the latter being lifted by baffles as it passes through and is distributed between the steam pipes. At the discharge end, the pomace falls, through slots

in the periphery of the shell, into a hood, from which it is conveyed to storage.

The juice from both pressings is mingled and passes to fermentation vats, built of California redwood. It has been found in this plant that fermentation by pure selected yeast gives a finer-flavored product and a larger yield of alcohol than is otherwise possible. The operation is controlled in the following manner: A 1-gal. bottle of pasteurized juice is inoculated with pure yeast and allowed to begin active fermentation, after which it is poured into an 18,000-gal. fermentation tank with about 300 gal. of fresh juice and allowed to ferment for 24 hours. The juice from the presses is then pumped in until the tank is full. Fermentation of the contents of the entire tank is complete in about 3 weeks. It has been found that 1 gal. of juice under active fermentation with pure yeast will overcome and dominate the fermentation by natural wild yeasts in the fresh juice. When fermentation is complete, the juice is pumped into tightly covered storage tanks and held until needed in the generators.

The formation of acetic acid from alcohol by the action of the so-called vinegar bacteria necessitates an adequate supply of oxygen. The reaction takes place in a cylindrical tank, also of California redwood, known as a generator, which consists essentially of three compartments. A division plate near the top is arranged with dumps or "spargers" for the even distribution of the juice into the compartment below, which occupies most of the volume of the tank. This is filled with beech shavings or corncob packing, which rests on a bottom support. The large surface available permits rapid increase in the bacteria and prompt conversion of alcohol into acetic acid.

The cider is delivered through a hole in the center of the cover and falls into one of two compartments of a tilting trough. This dumps its contents, when full, thus permitting an even flow of the liquor through the holes in the distributor. As the contents of one compartment are dumped, the other compartment comes into position and receives the cider; and when this is full the operation is repeated. The packing in the generator is thus subjected to a periodic drenching with cider.

Underneath the bottom support a shallow compartment is provided for the collection of the vinegar. Into this space are bored, obliquely, several vents through the walls of the generator, to provide an adequate supply of air. The temperature of the active zone is maintained at about 90 deg. F. A tight cover and a water-cooled condenser at the top of each generator serve to prevent evaporation losses.

In making a wash liquor for the generators, it is customary to add strong vinegar to the alcoholic juice, so that the mixture contains about 2.5 per cent alcohol. The average Watsonville apple yields a juice with about 14 per cent sugar, from which a 7 per cent alcohol is obtained. The vinegar produced contains a little over 6 per cent, or 60 grains of acetic acid per 1,000.

Vinegar from the generators is held in storage for a few weeks until traces of alcohol have gone over to acetic acid. It is then pumped through pulp filters to tanks, from which it is filled into barrels or bottles, or pumped into tank cars for shipment in bulk. Bottled vinegar is pasteurized at 160 deg. F. to prevent cloudiness on storage.

The Karl Kiefer filter, used for the clarification of the vinegar, is operated in conjunction with a hydraulic packer, which prepares the filter disks from the cotton pulp used. The thickness of each filter cell can be varied according to requirements. In making a cell, half the quantity of wet pulp needed is placed in the packer. Two disks of fine tinned-copper screening are then placed centrally, and the remaining moiety of the pulp is added. The apparatus is then closed and hydraulic pressure is applied. The cake of filter material is then placed on a coarse-screen disk and lowered into the press chamber. After a sufficient number of these and separating screens have been added, the cover is replaced and pressure is applied by means of a hand screw, whereby the central port is sealed with the cotton pulp.

In operating the Kiefer filter, gravity pressure is generally used, although controlled pump pressure is also suitable. The entering liquor passes into the filter chamber and up and around the edge of the filter cells. By means of the coarse-screen separating disks it is then distributed, passing through the pulp to the fine-screen disks, thence to the central opening and so out of the filter to storage. When rate of flow has fallen below an economic minimum, indicating blocking of the pores of the filtering cells, the incoming liquor is diverted to another filter, the disks are removed and the cotton is disintegrated to a pulp and washed in a special machine with hot water. The cleaned pulp then goes to the packer, again to be made into filter cells.

Chemical Control a Feature

Complete and regular laboratory control of all phases of operation of the plant is a feature of operations. Sugars, solids and acidities are determined daily on the raw material used, as well as on the wet and dry pomace and juice. Acidity and alcohol are determined on the fermented juice, wash liquors and finished vinegar. Acidity is determined daily on the vinegar from each separate generator, and the operation of each is regulated accordingly. Special attention is given to investigation and research work, with a view to improving production or preventing waste.

Chemical control of operation is in the hands of F. D. Merrill, to whom, as well as to G. C. Jones, president of the company, *Chem. & Met.* is indebted for permission to visit the plant and for co-operation in preparing this account.

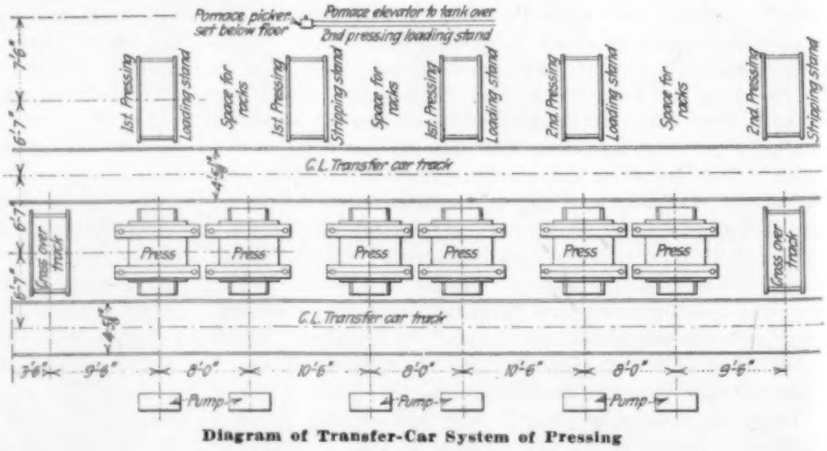


Diagram of Transfer-Car System of Pressing

Summary of British Low-Temperature Carbonizing Methods

In This, the Concluding Article of the Series, the Present Trends and Future Prospects of This Growing Industry Are Discussed

By C. H. S. Tupholme
London, England

Summing up the extensive experiments in low-temperature carbonization that have been described during the last year in Chem. & Met., the author of the series points out the motives that have impelled the English Government and people to interest themselves so deeply in this development. The prospective shortage of fuel oil, which has caused them so much concern, has not as yet become a source of concern in the United States. If, however, the supply of petroleum in our control grows inadequate to supply our needs, as is predicted by many experts, we too shall need to cast about for something with which to supplement it. When that time comes, it will be of great advantage to us that we can profit from the experience gained in England's pioneer work along these lines.

FROM time to time during the past year, I have had published in *Chem. & Met.* articles describing the most important developments in low-temperature carbonization practice in Great Britain. The more prominent of the systems devised have been discussed in detail and results from actual operation have been given. In this, the final article of the series, I shall describe the motives that have caused the British Government and people to pay so much attention to this process and shall point out what future developments the present trend of this new industry indicates.

There is, of course, a number of other low-temperature distillation processes extant in Britain and Europe, but the great majority of these are still in the experimental stage, and, until further developments take place, no useful purpose would be served in describing them.

To sum up, then, as the British Fuel Economy Committee says, it appears that the only practicable way in which future domestic supplies of motor spirit and fuel oils can be extended is by the carbonization of bituminous coals at temperatures between 600 and 1,200 deg. C. By distilling suitable British coals at high temperatures (1,000 to 1,200 deg. C.) in gas retorts or byproduct coke ovens, there can be obtained between 3 and 6 per cent of the weight of the dry coal as anhydrous tar, and between 0.75 and 1 per cent of its weight as refined benzol or motor spirit.

It should be borne in mind that inasmuch as more than half of the coal so distilled is for the production of hard metallurgical coke, the total production of motor spirit and tars by these methods depends upon conditions in the iron and steel industries, which are susceptible to fluctuation between wide limits. If prewar conditions were restored to these industries, a total high-temperature distillation of about 40 million tons of coal per annum might reasonably be expected. Taking 1 per cent of its weight as a probable outside limit for the ultimate production of refined benzol, the total potential production of this motor spirit would not exceed 400,000 tons per annum, which is very little more than half the tonnage imported into Britain in 1921.

Of this potential supply nearly half would have to be drawn from the gas works of the country, and it is at least problematical whether it would pay the gas plants to extract benzol from their gas at present prices. Indeed, taking the present relative prices of gas and benzol, as well as the costs of recovering the benzol, it is probable that the cash value of the potential heating power of benzol is greater when left in the gas than when extracted and sold as motor spirit.

It has, therefore, to be recognized that the most promising internal supply of both motor spirit and fuel oils lies in the direction of the low-temperature distillation of coal. A really successful solution of this problem is greatly to be desired, not only for the reasons given above, but also because it would be a great factor in the abolition of the smoke nuisance, especially from domestic fires.

This committee has paid close attention to recent developments in distillation that are taking place in Britain, and is in general agreement with the view recently expressed by the Fuel Research Board that we have hardly reached a stage when an answer can be given to the question whether or not it will be possible to establish on sound industrial lines a new industry based on the distillation of the tens of millions of tons of coal per annum that are at present being consumed in this country, though, as a result of the recent pioneer work, the experience gained affords some ground for the expectation that we are approaching a final solution of the problem.

There is still some difference of opinion as to whether from the commercial point of view it is better to distill at temperatures around 600 deg. C. or somewhat higher, say 700 to 750 deg. C., but this may be regarded as a minor issue. It seems now to be established, as a result of commercial-scale trials, that the average yields of the various products now obtainable by distilling suitable British bituminous coals at a temperature of 600 deg. C. will amount, on the weight of the dry coal carbonized, to about 7.5 per cent of tars, 2.5 gal. per ton of motor spirit, 3,500 cu.ft. of rich gas of about 800 B.t.u., and 70 to 80 per cent smokeless semi-coke.

Seeing that the cash value of the semi-coke residue far exceeds that of all the other products put together, and also that the price of fuel oil in Britain will probably also be determined by circumstances beyond our control, it seems that the ultimate prospects of a low-temperature distillation industry will depend upon the price the public will be willing to pay for a smokeless domestic fuel.

There is little doubt that such a fuel, properly manufactured, is a very suitable one for domestic consumption. It burns freely and smokelessly and has a greater radiant efficiency than either coal or high-temperature coke. Its general adoption, however, will depend upon the fulfillment of two other conditions. First, it must be prepared and distributed in a form that will allow it to be freely handled without undue disintegration. Second, if its ash content could be cheaply reduced to a low figure by subjecting the coal to some washing process before it is distilled, its attractiveness as a domestic fuel would be greatly increased.

Splendid Progress in Field of Colloids

Second Meeting of Colloid Chemists Successful Both in Number Attending and in Importance of Results

Editorial Staff Report

THE service of colloids in industry and theories of colloidal phenomena were both discussed in the Second National Colloid Symposium at Northwestern University laboratories on June 18 to 21. The participation of nearly 300 persons made for enthusiastic as well as profitable sessions of the conference, which is unique in one particular, that it is held without organization or the formal sponsorship of any society or institution. The formal papers are prepared on invitation of the colloid committee of the National Research Council and some member of this committee presides at each session, but membership and participation is open to all interested.

Prof. Harry N. Holmes, of Oberlin College, is chairman of this committee.

Dr. Frank C. Whitmore, head of the chemistry department of Northwestern University, was in charge of dormitory, registration and other local arrangements, all of which were splendidly executed for the convenience of the out-of-town members, who numbered about 150.

The 1925 symposium is to be held at Minneapolis, where plans will be in charge of Prof. Ross A. Gortner, of the University of Minnesota. Talk of a 1926 symposium in Ann Arbor, Mich., shows the enthusiasm and certainty of annual recurrence of these meetings. The important industrial applications of colloids and colloidal phenomena, which brought as many industrial men as theoretical workers to this year's sessions, also contributes further to the future prospects of these meetings.

Colloid Adsorption Classified

One of the outstanding papers of the symposium was by Prof. L. Michaelis, the internationally famous authority who formerly was at Berlin University and is now at Aichi University of Japan. Speaking on the subject "General Principles of Ion Effects on Colloids," he proposed an entirely new scheme for classification of the phenomena of adsorption on colloids. The direct adsorption takes place in one of three ways, but always with the aid of the electric double layers on surfaces of the colloid particles; the indirect adsorption does not involve electric or ionic phenomena, but results from a sharing of solvent by the hydrophylic colloid and by the adsorbed substance.

Direct adsorption occurs usually in dilute solution where ionization or hydrolysis are a maximum; but indirect adsorption is possible only in rather concentrated solutions where there is insufficient solvent to satisfy fully both colloid solvation and the solvent desire of the non-colloid solute. Both therefore attempt to hold the solvent (usually water) and as a result the non-colloid is attached in an "indirect" manner, without regard to electric charge or polarity, giving the same general effect as if truly adsorbed on the colloid itself. This distinction affords explanation of numerous important differences in salt retention with variation in concentration which are not clear if considered only as direct adsorption on an electric basis.

Michaelis further classifies direct adsorption into three groups, as follows:

(*a*) Adsorption by apposition, in which ions either positive or negative are adsorbed on the partial valences of compounds, the character of ion retained thus being determined by which is in excess in the solution. Thus either Ag or Cl ions are held on AgCl precipitate in accordance with the excess of silver salt or of chloride in the solution.

(*b*) Adsorption by dissociation, in which the charge on the colloid particle is formed by a phenomenon like that of dissociation of a salt into ions. The charged colloid then holds oppositely charged substances which were previously in true solution.

(*c*) Surface adsorption, in which the colloid affords electric attraction by the fact that the surface molecules are oriented and thus expose only either plus or minus charges to attract dissolved ions of opposite sign. This, of course, occurs only with colloids of bipolar compounds.

By following out this classification it is expected that better control of colloid action can be had, since increase or decrease in adsorbed material will be best accomplished by different schemes, according to the mechanism of the adsorption.

Grain Size in Photo Emulsions

Grains of silver bromo-iodide vary in iodine content in photographic emulsions according to the size of the grains, the larger particles being higher in iodide and lower in bromide content. This important explanation of varying speed of photographic emulsions was proved by V. B. Sease and F. F. Renwick, of the du Pont company, in their paper, "The Study of Grain Size and Grain Distribution by an Improved Method of Sedimentation." Turbidity tests, micro-examination of emulsions and chemical analysis of sections of sedimented jellies were used to check the distribution of colloids after settling in slowly cooled (and hence slowly jelled) emulsions. The differences were as much as 10 to 15 per cent in colloid composition between top and bottom layers; and the differences clearly were because of particle size being in the reverse direction to that expected from differences in specific gravity of iodide and bromide.

The method of slow cooling or heating is recommended for use in studying sedimentation effects in other emulsions that cannot otherwise be accurately sampled for analysis or micro-examination.

Properties of Clays

A. V. Bleininger, of the Homer-Laughlin China Co., Newell, W. Va., presented a general survey of the properties of clays as affected by their colloid charac-

National Colloid Symposium, Evanston, Ill., June 18 to 21, 1924

teristics. The purpose as stated by this speaker was "to arouse interest and sympathy" for the ceramist in use of clays, rather than to expound any theory or cure-all. A wide variety of tests of placticity of clays have been proposed, but no other is anything like as good as the test of workability on the potter's wheel.

The plasticity, which depends upon colloid character and percentage content, determines shrinkage, water-absorbing power and general behavior on molding, casting, etc. In practice often the purification of clay affects these properties; for example, some clays may be much improved for paper fillers but ruined for ceramic use if coagulated and then again deflocculated. Kataphoresis for purification may also be useful or useless, according to circumstances. In use of clays for casting deflocculation is gaged in the mixer by the sudden change in fluidity of the suspension when just enough electrolyte has been added. At this point the power to run the mixer drops abruptly and vigorous splashing is noted. Preheating clays to 300 to 400 deg. C. to set the gels often gives the best results for the casting process, a fact probably most important for refractory making. These and other facts are all related to colloid behavior, but as yet in ways not clearly understood. Extensive further research is urged.

Acid and Alkali Adsorption

The power of proteins to "bind" acid and alkali has been investigated for several years by Ross A. Gortner and associates at the University of Minnesota. A résumé of their research reveals a complete explanation of the causes of difference in conclusions of earlier workers who have given opposing theories based on work under slight differences of conditions. Within the range of hydrogen-ion concentration of p_H 2.5 to 10.5, the binding power of proteins is due to adsorption on the colloid. Outside this "neutral" range, the action is chemical combination. Thus both schools of thought have been correct, but both failed to define the limits of their work in sufficient detail.

Seventeen different proteins have identical "buffer curves" of neutralization and all have equal acid binding power despite wide differences of content of nitrogen in various types of compounds. There is a distinct temperature coefficient of binding power and in the direction to be expected by theory. These curves of temperature effect come to a focus at the two critical values of p_H 2.5 and 10.5.

An elaborate monograph is now ready for publication which will summarize the years of work by this group. The results apparently clear the stormy atmosphere with full satisfaction to both sides.

Two types of industrial equipment for colloid work were also exhibited. By request the Premier colloid mill, of the Premier Mill Corporation, Geneva, N. Y., and the Supercentrifuge of the Sharples Specialty Co., Philadelphia, were demonstrated and their applicability explained. Large-scale as well as laboratory applications have been made extensively by both these companies on a wide variety of industrial materials.

Emulsions Without Colloids

The formation of emulsions by means of colloids is widely applied industrially, but emulsion formation without a protective colloid has not been understood or explained. H. N. Holmes in his paper on "Emulsions" gave experimental evidence and an explanation of this important possibility. Iodine or iodides as emulsifying agents for ether and water have probably gained credit for the effect which was really caused by the presence of small quantities of alcohol. In any event any of the lower alcohols are effective. This fact leads to the theory that a substance that is mutually soluble in two immiscible liquids reduces the interfacial tension and hence may (but not necessarily will) be an emulsifying agent.

Apparently to be a success as emulsifying agent the third substance should be bipolar in molecular character. That is, it should have one end of its molecule of a nature similar to one of the liquids to be emulsified and the other end similar to the other liquid. A fatty acid is good as emulsifying agent for petroleum oils and water. The hydrocarbon end of the molecule tends to go into the oil, whereas the —COOH group tends to go into the water. So far as evidence yet studied is concerned, this simple schematic idea seems correct.

The relative bulk of the two ends of the molecules of emulsifying agent seems to determine which liquid will be the continuous and which the dispersed phase. Thus the wedge theory of interface action is applicable; in other words, the molecules of emulsifying agent tend to orient themselves in the surface of the droplets with their ends toward the liquids of preferred solubility.

The generalization that bipolar liquids aid in forming true emulsions is of great possibility as an explanation of non-colloid emulsifying agents. It implies a whole new field of emulsion formation and a new technique in control of emulsions in industry.

Experiences With

Aluminum as a Material of Construction in Chemical Engineering Industries

Results of a Questionnaire of the German Metallurgical Association Show the Metal's Advantages and Limitations in a Wide Variety of Industrial Equipment

Translated from *Chem.-Zeit.*, vol. 16, pp. 65 and 89, Feb. 6 and 20, 1924

EDITOR'S NOTE—Aluminum, as a material of construction in the chemical engineering industries, is of comparatively recent adoption. Very few attempts have been made to compile, in a comprehensive way, the experiences of its users.* The recent appearance in the *Chemiker-Zeitung* of the results of a questionnaire sent to the German chemical industries by the advisory council of the Metallurgical Association (Metallwirtschaftsbund) is therefore a welcome contribution to the chemical engineer's knowledge of this useful metal.

In the following translation the results of the questionnaire, particularly those of interest to *Chem. & Met.* readers, have been summarized and arranged in accordance with the uses investigated. The numbers following the individual items designate the firm supplying the information and should prove useful to those who wish to write to the compilers (Beratungsstelle des Metallwirtschaftbundes, Berlin, W. 10, Victoriastr. 12) for additional information. The notes in smaller type are the explanatory comments of the advisory council.

Acetic Acid—Very good results were obtained with apparatus of pure aluminum in the case of glacial acetic acid and strong acetic acid. No. 15.

Carboys of pure aluminum sheet were attacked and eaten through after a short time, probably due to impurities in the metal. No. 22.

Since many satisfactory experiences contradict this statement, the firm is justified in its assumption that an impure material was used in the manufacture of the article.

Distilling columns of aluminum have been used for many years. No. 59.

Sometimes good and sometimes bad results with aluminum tubes, the latter when the metal was not uniformly dense. No. 70.

Apparatus of the purest aluminum is advantageously used for its preparation. No. 76.

Aluminum apparatus gave satisfactory results in the manufacture of aluminum acetate. No. 79.

Pure aluminum apparatus is very stable at ordinary temperature, satisfactory for use and has a long life. At elevated temperatures it is resistant to acetic acid only between 90 and 99.6 per cent; dilute acetic acid (under 90 per cent) and anhydrous acetic acid attack aluminum. No. 82.

*A critical bibliography of the corrosion of aluminum has been compiled and interpreted by Harold F. Whittaker, of the National Research Council. This has been issued in mimeographed form as Bulletin No. 2 of Research Information Surveys on Corrosion of Metals, Research Information Service, National Research Council, Washington, D. C.

Acetic Ester—The practically anhydrous solvent does not attack apparatus of pure aluminum, even in the presence of small amounts of acid (acetic or sulphuric). No. 82.

Acids, Inorganic—Not useful with weak acids. No. 78.

On the ground of reports from other companies, this statement should be limited to say that aluminum is not useful with weak acids at elevated temperatures.

Alcohols—Distillation vessels of pure aluminum have been very satisfactory. No. 44.

Alkaline Earth Products—Good results with drying pans made from 99 per cent hard-rolled pure aluminum at temperatures up to 70 deg. High stability, wear merely mechanical. No. 41.

Alkaline Liquors—Good results with weak alkalis. Pure aluminum used 3 to 4 years without difficulty. No. 4.

When water glass and alkali silicates are used, aluminum is dissolved with the development of hydrogen. Not usable. No. 8.

Aluminum apparatus is destroyed by soda and alkali liquors. Not usable. No. 35.

Aluminum containers cannot be used for the manufacture of chemical preparations that contain dilute acids or weak alkalis, since traces of the aluminum enter the preparations. No. 68.

We have here to deal with the special case of pharmaceutical preparations. There are, however, a whole series of products in which traces of aluminum are harmless. Accordingly one could make the general rule: In the case of preparations in which aluminum itself in traces is undesired, the materials used must not have an acid or basic character, since otherwise traces of aluminum may appear in the final product.

Aluminum cannot be used with weak inorganic acids and alkalis. No. 78.

In this general form, the statement is probably too broad. The important part of this experience would perhaps be better expressed by saying that aluminum cannot be used at elevated temperatures for materials containing small amounts of halogen acids, and that the same applies to strong alkali in solution.

Aluminum Sulphate and Aluminum Sulphate Liquors—Aluminum is unsuited to replace lead in evaporating apparatus, since it is destroyed in a short time by the hot liquors (on account of the sulphuric acid content).

Aluminum boxes for delivery of aluminum sulphate showed strong corrosion after a few months. No. 97.

Ammonia—Pure aluminum has been used for 14 years without difficulty, to heat (under pressure) a strongly ammoniacal solution. No. 21.

Vessels of purest aluminum (99 to 99.5 per cent) are the most satisfactory; less pure aluminum showed corrosion, especially at the points where it was welded. No. 25.

The durability of a weld depends primarily on its technically correct production. Above everything, care must be taken that no holes or funnel-shaped depressions remain in the weld. These form the starting points for destruction by corrosion. The chemical resistance is also highly dependent upon the welding flux used. Properly made welds are as resistant to mechanical stresses as the aluminum itself.

Aluminum of at least 99 per cent purity, which is dense in structure, showed good stability in apparatus for preparing ammonium nitrate from ammonia gas and nitric acid; likewise in the form of tubes for cooling the hot ammonium nitrate liquor. No. 55.

Pure aluminum tubes have behaved well with ammonia-air mixtures containing 7 to 9 per cent of ammonia at temperatures up to 300 deg. C. No. 62.

Pure aluminum steam-heating coils in evaporating tubs showed a varying behavior toward weakly ammoniacal solution. Sometimes they remained unchanged, and sometimes they became covered with a deep brown crust, and contaminated the solution. No. 76.

The covering of the heating coils with a brown crust is a phenomenon which does not occur normally—i.e., with a sufficiently pure aluminum and pure liquor. One can therefore establish the fundamental rule that pure aluminum heating coils remain unchanged, but the lower grade aluminum becomes covered with a brown crust and contaminates the solution.

Ammonium Sulphide—Vessels of the purest aluminum are satisfactory even at elevated temperature. Aluminum is the only metal except the noble metals which can be used with ammonium sulphide. No. 35.

Benzol—Aluminum may well be used in the case of easily flammable liquids for measuring apparatus and evaporating dishes, since it furnishes insurance against the formation of sparks and explosion. No. 16.

Blast-Furnace Gases—Blast-furnace tuyeres of cast aluminum containing 8 per cent copper have behaved very well. No. 43.

The tuyeres of the blast furnace have the function of introducing the hot blast from the stoves into the furnace. They suffer less from the furnace gases than from the temperature which obtains in the furnace, which burns out the ordinary copper or bronze tuyeres after a while, so that they leak and thereby become useless. In replacing these parts by aluminum, advantage is taken of the higher specific heat and thermal conductivity of the latter.

Carbolic Acid (See Also Phenol)—Aluminum apparatus is very sensitive to the phenols, and prospective users are warned against it. No. 15.

Carbonic Acid (Carbon Dioxide)—Mixing and filling apparatus of sheet aluminum, 98 to 99 per cent, has been in use from 2 to 3 years (up to 10 atmospheres pressure) and showed excellent stability and resistance to dilute lactic and carbonic acids. No. 2.

Chromium Oxide—Aluminum trays give very good results for drying this material—in fact, much better than those of iron or galvanized iron. No. 48.

Citric Acid—Purest aluminum (99 to 99.5 per cent) is the most suitable. No. 25.

Copal—Aluminum kettles have behaved very well for many years in melting copals, resins, etc., and in boiling linseed oil, blown oil, etc. It is advantageous to make the bottoms of copper. No. 74.

Cresols—Pure aluminum distillation vessels cannot be used on account of the vigorous evolution of hydrogen when the cresol is boiled. No. 44.

Dyestuffs—Aluminum drying pans have behaved well; they show considerably longer life than those made from lead-covered iron or from wood. No. 63.

Ethyl Chloride—Not satisfactory for closures for vessels that contain ethyl chloride, since the aluminum is attacked. No. 1.

Extracts and Essences—Aluminum vessels and distilling flasks in general behave well. No. 80.

Aluminum bottles as containers have given excellent service. No. 86.

Pure aluminum vessels used for heating have so far shown no disadvantages. No. 90.

Fats and Fatty Acids—Filter presses of aluminum behave well. No. 72.

An aluminum tub has been used for storage since 1914; results satisfactory, especially for fatty acids, which quickly attacked iron and wooden tubs lined with lead. No. 83.

Drying vessels, montejus, overflow tubes and condenser tubes have behaved well and may be used without difficulty. No. 47.

Excellent results with aluminum apparatus for steam distillation of fatty acids and resin acids. The acids stay colorless in aluminum apparatus, while they easily become colored in apparatus of other metals. No. 18.

Distillation vessel of aluminum showed "pock-mark" corrosions, which finally ate through the metal; some of them are probably to be ascribed to poor workmanship. Preliminary laboratory experiments showed no attack. No. 44.

Since the laboratory experiments contradict the plant experience, the corrosion that occurred in operation must be ascribed to causes other than lack of the ability of aluminum to withstand corrosion. Evidently it was a case of impure or non-uniform aluminum, or else the assumption of the company is correct—i.e., poor workmanship in the manufacture of the vessel in question, so that it was made non-uniform in structure and therefore in potential by hammering, and thus was predisposed to electrolytic solution.

There is also the possibility that the products used in the distilling vessel were considerably different in character from those used in the laboratory, and as a result the vapors contained corrosive impurities.

Glue—Aluminum screens have been satisfactory for drying glue. No. 71.

Hydrochloric Acid—Aluminum apparatus and pipe lines are strongly attacked by hydrochloric acid, both cold and hot, and are therefore unsuitable. No. 101.

Aluminum apparatus is strongly attacked by hydrochloric acid. No. 58.

Aluminum cannot be used for hydrochloric acid at 100 deg., since it is not resistant. No. 69.

Hydrofluoric Acid—Apparatus of cast pure aluminum strongly attacked. Results unsatisfactory. No. 58.

Linseed Oil (See Copal)—Aluminum kettles caused no difficulties in the preparation of linseed oil varnish. No. 40.

Mercury and Mercury Salts—These dissolve aluminum rapidly by amalgamation. No. 78.

Detonating caps of aluminum cannot be used for the ordinary detonator (mercury fulminate), since the metal is attacked. No. 96.

Nitric Acid—Cooling tubes and storage vessels of aluminum of the highest purity have behaved well; even when, in the concentration of the nitric acid vapors, 1 to 2 per cent sulphuric acid ran through the aluminum tubes. No. 6.

Aluminum siphons for drawing off the acid are stable in the presence of concentrated nitric acid, but the acid that adheres to them absorbs water from the air and quickly becomes diluted, and then attacks the aluminum. No. 17.

In the manufacture of nitric acid, aluminum pipe lines were used, but had to be later replaced by ferrosilicon, since the aluminum was quite strongly attacked.

Aluminum siphons, replacing glass ones, have been used with good results for handling nitric acid, both 36 deg. Bé. and 29 to 31 deg. Bé. No. 33.

Aluminum sheet and aluminum vessels have given good service in the manufacture of the noble metals, and have shown a considerably longer life in the presence of nitric acid than the copper vessels previously used. No. 39.

Laboratory experiments with sulphuric acid containing oxides of nitrogen and nitric acid gave practically no loss in weight, both with pure aluminum and duralumin. No. 50.

Pure aluminum tubes are very well suited for carrying away nitrous gases. No. 35.

Aluminum tubes have behaved well for nitrous gases (98 to 99 per cent aluminum). Dry gases did not attack the aluminum at all, wet gases only when hot. Mechanically stressed parts and welds are more easily attacked. The aluminum is also used for pipe lines for nitric acid in all concentrations. At ordinary temperatures aluminum is practically unattacked, thick-walled tubes less than thin-walled ones; tubes of 5 mm. wall thickness have been in use 3 years without trouble. Aluminum is not stable toward warm or hot acids. Silumin (Alpax) is not usable for nitric acid, since laboratory experiments show a vigorous attack. No. 52.

We use 99 per cent aluminum in our nitrogen plants for concentrated and dilute nitric acid, as well as for ammonium nitrate liquor, but only as an auxiliary material, since according to our experience the welded places very often give trouble. No. 99.

Very good experience with 98 per cent aluminum as pipe for carrying cold nitric acid of 30 to 35 deg. Bé., and as pipe, tank and tank car for 96 to 98 per cent nitric acid. While iron pipes show unfavorable catalytic properties both in the burning of ammonia and in decomposition of oxides of nitrogen, aluminum is completely stable toward the oxides of nitrogen so long as a concentration is avoided. No. 55.

Aluminum tanks have been used in the heavy chemical industry for many years for the transportation of highly concentrated nitric acid. No. 59.

Aluminum pipe lines showed very good results for both very strong and quite dilute nitric acid. No. 63.

Vessels for storage and transportation, weighing vessels, acid eggs and pressure pipes made of 99.5 per cent pure aluminum have behaved excellently with nitric acid over 36 deg. Bé.; they behaved better the more concentrated the acid and the purer the aluminum. The acid must be free from chlorine and should not contain more than 0.2 per cent of nitrous acid. In the case of acid below 36 deg. Bé., aluminum containers are quickly eaten through, especially at the welds. The filling pipes of the vessel are more easily attacked on account of the presence of air. No. 75.

Aluminum of the highest purity in the form of protective or guide sheets for covers and ventilator supports, as well as sheets without welds, used for armor (vents and supports of cast aluminum), showed itself to be very resistant to nitric acid vapors and to a mixture of dilute sulphuric and nitric acids up to 5 per cent. No. 87.

Pots of pure sheet aluminum for nitrating have behaved well up to 80 deg. C., and also continuously in the presence of boiling dilute (2 per cent) nitric acid. A centrifuge casing of cast aluminum (composition unknown) was stable only at room temperature. At higher temperatures it was attacked by the acid. Aluminum covers for nitro-cellulose washing vessels have behaved well. No. 91.

Pure aluminum tubes are satisfactorily used for carrying the acid, in so far as the nitric acid is free from hydrochloric, otherwise they are not usable. No. 92.

Nitrocellulose—For apparatus and vessels where the formation of sparks must be prevented, aluminum has been satisfactory in the plant. No. 75.

Oils—Distillation vessels, blowing and mixing vessels, and cooling tubes of aluminum have behaved well for 14 years. The greatest advantage of the aluminum vessels is that distilled oils remain light colored. Careful handling is necessary, as well as care to keep away from alkalis. No. 15.

Crystallizing vessels of aluminum have been used for a long time, and have been satisfactory. Recently a distilling vessel for rectification of ethereal oils and liquid artificial perfumes has been put in operation. No final decision can be given as to its usefulness, but it seems that the aluminum is slightly attacked by some of these substances. No. 64.

Apparatus of aluminum has behaved very well for oils and organic substances which do not contain acid. No. 44.

Oils, Ethereal—Pure aluminum vessels have been used for export purposes with excellent results; on the contrary aluminum distillation apparatus was not useful, because the resinous residues could be removed only with boiling soda. No. 51.

Para-Aldehyde—Aluminum apparatus is not attacked by para-aldehyde, even in the presence of small amounts of acid (acetic or sulphuric acid). No. 82.

Paraffine—Aluminum inserts in kettles are not attacked by the weak organic acids in wax or paraffine. No. 45.

Phenols—Apparatus of aluminum for the preparation of carbolic acid was not satisfactory, since the aluminum was rapidly attacked. No. 61.

With regard to the attack of the metal by tar oils containing phenol, an investigation was made (see *Brennstoffchemie*, Jan. 1, 1921) in the Kaiser Wilhelm Institut für Kohlenforschung, the result of which as far as aluminum is concerned was: Aluminum loss of weight in milligrams per square centimeter: 0.0. Accordingly one should be able to use aluminum for tubes and sheet which come in contact with tar oils containing phenol.

Distillation apparatus sometimes showed itself to be very resistant; sometimes after being used once or twice there appeared round points of corrosion, which are to be ascribed either to the sodium content of the aluminum or probably to particles of foreign metals rolled into it. Laboratory experiments with organic bodies containing phenol showed unlimited stability in the case of pure aluminum. No. 62.

Phosphoric Acid—Apparatus of aluminum gave bad results, as the aluminum was at once rapidly attacked. No. 7.

Picric Acid—Aluminum plates have not been satisfactory for drying purposes, since the material to be dried, in addition to moisture, also contained alkalis or acids. Moreover, the aluminum used was made during the war, and contained too much silicon. No. 14.

The note that the aluminum was made during the war offers another confirmation of the fact that at that time unfortunately an impure material was produced which was very easily worn out.

Potassium Chlorate—Aluminum drying pans have been satisfactory. No. 62.

Potassium Nitrate—Aluminum vessels and containers have behaved well, and were not attacked by the hot potassium nitrate and nitride solutions. No. 55.

Potassium nitrate solution does not attack pure aluminum any more than water does. No. 1.

Potassium Silicate—Aluminum vessels cannot be used, because aluminum is dissolved with the evolution of hydrogen. No. 8.

Salt Water (Common Salt)—Aluminum vessels are strongly attacked after a short time; not to be used with liquids containing salt. No. 2.

This conclusion seems too broad. It is known that such difficulties occur only when the aluminum is too impure or shows casting faults or faults of working and heat-treatment. In general, it is advisable to avoid water containing sodium chloride as much as possible, since aluminum of lower purity or which is otherwise defective will at times be attacked by it.

Sodium Nitrate. See Potassium Nitrate.

Sodium Silicate. See Potassium Silicate.

Silk, Artificial—We use aluminum in the manufacture of artificial silk, and indeed the spinning bobbins are made of pure aluminum. However, these are lacquered before use, so that the bobbins are not attacked by the acids. We noted, however, that in our film factory, where aluminum is also used for the manufacture of artificial silk, difficulties developed when the iron content was high. Parts made from an aluminum containing 1.34 per cent iron and 0.62 per cent silicon quickly became useless, while aluminum with an iron and silicon content of 0.5 per cent each was not attacked. Aluminum with a high iron content can be recognized by the fact that it turns black on moistening with 1 per cent caustic soda. No. 99.

We have for a long time used a large amount of aluminum in our operations, but have observed that so far it has not been possible to find an aluminum alloy that is reasonably stable against dilute acids. For example, we observe in the case of spinning bobbins that these are subjected to a relatively considerable depreciation. For some time we have attempted to use aluminum as a substitute for copper and brass, but these experiments have not yet reached the point where one can draw definite conclusions from them. No. 98.

Sugar Solutions—Aluminum vessels for heating have so far shown no disadvantages whatever. No. 90.

Sulphuric Acid—Aluminum apparatus cannot be used in the preparation of superphosphate, since it is strongly attacked by concentrated sulphuric acid. Only lead-lined vessels can be used here. No. 69.

Tin Chloride—Aluminum proved unsatisfactory for storage of tin chloride solution. No. 101.

Trichlorethylene—Aluminum vessels are not attacked by trichlorethylene even in the presence of small amounts of acids (acetic or sulphuric acids). No. 82.

Conclusions

The Advisory Office remarks as follows regarding these statements:

The collection of these results brings together a satisfactory amount of valuable matter for judging the usefulness of aluminum in the chemical industry, even if here and there some contradictions occur. It is to be noted that complaint is frequently made about the unsatisfactory resistance of welded places, the behavior of which should give no cause for such observations if the welding is properly done.

In general, it can be said that aluminum can be used to advantage in many more places than previously. With its low specific gravity and its low price in comparison with copper and brass, aluminum shows a relatively higher resistance than many other metals to different chemical influences, and therefore will give longer life to the apparatus.

In many places the bad results are not to be ascribed to the aluminum itself, but are due solely to the fact that the degree of purity of the aluminum used was insufficient. Probably if purer aluminum had been used, better results would have been obtained in the same place. Moreover, a thorough experimental investigation is necessary to show whether in the case of many uses a special aluminum alloy would not have been better than pure aluminum.

Further, it is worth while considering whether in the case of the apparatus in which water plays an important part, aluminum should not be chosen as a material of construction, and at the surfaces in contact with the particular reagents protected by a special coating of another metal, lacquer, or the like. The result of the questionnaire can therefore not be considered to be a final judgment as to the use of aluminum.

The Advisory Office will be glad to have as many firms as possible take part in a further exchange of ideas, communicate further their own experiences, or ask further questions about the experiences of others.

Promoting Co-operation in a Competitive Industry

Mutual Understanding Developed by Outing of Synthetic Organic Chemical Manufacturers Association Helps to Unite Industry—Dr. Breithut and Judge DeVries Discuss Status of European Dye Industry and Customs Litigation

BROUGHT into existence under the stress of wartime necessity and forced to meet endless opposition, the manufacture of synthetic organic chemicals in this country presents the interesting case of a competitive industry the very life of which depends upon co-operation. Without a thorough understanding of the other fellow's viewpoint gained through personal association, effective discussion of common problems is difficult. And as there is no better way to get acquainted than to play together, the late afternoon of Thursday, June 19, found sixty members of the Synthetic Organic Chemical Manufacturers Association en route to the Wyandotte Inn, Bellport, L. I., for a week end of golf, tennis and other sports.

The golf tournament Friday over the attractive 18-hole course of the Bellport Country Club was a feature of the recreational program. There were about thirty entries and prizes were awarded for low gross scores to A. H. Pierce and B. T. Bush; for low net to W. S. Weeks, S. C. Moody, S. W. Picard and K. H. Klipstein.

While the recreational features were duly emphasized, some attention was given to more serious business. It so happened that Dr. Frederick E. Breithut, who has been trade commissioner at Berlin for the past year, arrived from Europe Thursday afternoon just in time to join the party on the train. Thursday evening he was called upon to relate some of his interesting experiences. Friday morning, by special arrangement, Judge Marion DeVries, senior counsel for the association, outlined the present status of customs litigation.

Status of European Dye Industry

For more than an hour Thursday evening Dr. Breithut held the attention of the members with a most entertaining and instructive summary of his experiences in investigating the dye industries in a number of European countries. France, England, Switzerland, Italy, Czechoslovakia, Poland and Germany were visited. As detailed reports on all these countries either have been or will soon be issued by the Chemical Division of the Bureau of Foreign and Domestic Commerce (that for Great Britain was abstracted in *Chem. & Met.*, June 2, 1924, p. 869), Dr. Breithut limited his remarks to a general view of conditions. In France he met everywhere with extreme politeness, but found it very difficult to get any real information. Switzerland, with four big companies operating, and Germany, with her Interessen Gemeinschaft, are both beginning to realize that the American tariff law offers a severe obstacle. England is producing about 80 per cent of her requirements. Dr. Breithut investigated the rumored merger of interests of the British Dyestuffs Corporation with the I.G. from both angles and was informed by the Germans that while no agreement had been signed, an understanding existed and England might awake some morning to find the agreement effective.

In Italy some of the companies are elaborately overbuilt and all seem to be passing into German control.

German propaganda has taken a new form in the establishment of a series of chain stores displaying indanthrene dyes. Attractive post-cards and circulars in many languages have also been distributed for the purpose of creating a demand for this group of dyes.

Customs Litigation

In his address Friday morning Judge DeVries emphasized the fact that the tariff act was really drawn up on the basis of foreign valuation and at the last minute special provisions for American valuation were injected, constituting sections 27 and 28. As these sections were not in complete harmony with the rest of the act, it was necessary to permit the Secretary of the Treasury to promulgate regulations that would make these provisions workable. The courts have held that such regulations have the same force as the law and the importers, recognizing this, immediately brought cases before the Board of General Appraisers, presumably in the hope that the litigation might result in court decisions that would offset somewhat the subsequent regulations. Arguments were presented on a number of points, but all were overruled by the board. Appeals were made to the United States Court of Customs Appeals, which, after hearing briefs, has ordered back to the Board of General Appraisers all records with a request for a finding of fact on all points involved. The speaker emphasized the importance of this action, for it means that the decision will be made with full information as to the facts and the law on each point.

Reference was made to the important work which H. F. Wilmot has been doing for the association at the Appraiser's Stores, keeping the appraisers informed as to comparable dyes. With the proper duty rate, length of litigation has no effect on the industry.

American valuation is a question that is of interest to many industries, and Judge DeVries suggested bringing to the attention of the National Association of Manufacturers the fact that the Synthetic Organic Chemical Manufacturers Association is meeting the opposition to American valuation on one of the most difficult schedules. In a measure, it is thus fighting the battle for industry as a whole, for the decisions obtained may be of fundamental importance to the general problem.

Comparison of Direct Expansion and Brine in Applying Refrigeration

A Discussion of Conditions Governing the Application of Cooling by the Two Methods, With Particular Emphasis on Brine Cooling

By H. J. Macintire
Associate Professor of Refrigeration, University of Illinois

AFTER the decision has been made as to the system of refrigeration — absorption or compression—that is to be used in any given plant, it is necessary to decide whether the refrigeration shall be applied by direct expansion or by the circulation of cooled brine. Because of the numerous factors that enter into such a decision, it is not possible to give a definite answer to this question except in special cases. When carbon dioxide is used as the refrigerant, it is usually conceded that brine circulation must be adopted except in small plants and in some types of theater cooling. However, in plants using carbon dioxide and direct expansion there are several plants with 10,000 or more linear feet of piping. In such cases welded pipe may be used in order to eliminate flanged joints and thus decrease the likelihood of leakage.

With direct expansion piping for ammonia it is necessary to have an extremely tight system. With steam and compressed air piping a small leak is usually of little moment. With ammonia, however, such a leak is serious, both as regards the cost of refrigerant lost and also the danger to persons and commodities coming into contact with the mixture of air and ammonia. To maintain a tight pipe line with this gas it is necessary to have special fittings and very careful pipework with either tinned and soldered joints or litharge and glycerine thread joints.

In contrast, piping for brine circulation need not be special. The pressures are not usually greater than 25 lb. per sq.in. in excess of the static pressure due to the head of brine, and hence the pipe and fittings can be such as are usually employed for 125 lb. pressure work.

REFRIGERATION

In the first article of his current series, the author detailed some of the factors that influence an engineer to choose one system of refrigeration as against the others that may be available. In this, the second article, facts are brought out that should help the engineer in deciding how to apply refrigeration to his process in order to obtain the most satisfactory results.

A UNIT PROCESS OF CHEMICAL ENGINEERING

With the brine circulation system, however, there is required some sort of brine cooler—of the double pipe, shell and coil, or, more generally, of the shell and tube style. A circulating pump is also necessary. As the brine is used to absorb heat and its heat capacity is limited to a rise of temperature of a few degrees only, the brine pump must operate as long as refrigeration is desired unless tanks or tubes are used to hold a quantity of cold brine and act as a reservoir of refrigeration.

This last fact suggests one of the advantages of the use of brine—its capacity as a storage for refrigeration. This permits the brine-using plant to meet a sudden peak demand, such as occurs in the quenching of steel, the pasteurizing of milk, or in other cases where the cooling is done by batches. Under such conditions it is possible to use a brine storage tank of sufficient size to give the required storage capacity and permit the refrigerating machine to be operated continuously.

When the temperatures required are not below 32 deg. F., it is usual to substitute water for brine except when, as in the case of steel quenching, there are good reasons for the use of calcium or sodium chloride solution. Some kinds of work, such as air cooling and conditioning, are particularly adapted to the use of a spray, made by a nozzle designed to atomize the brine or water as finely as possible. The advantage of a spray in such cases is in the washing of the air; and, for low temperature, in the condensation of the moisture content of the air so as to make this content correspond to that for the

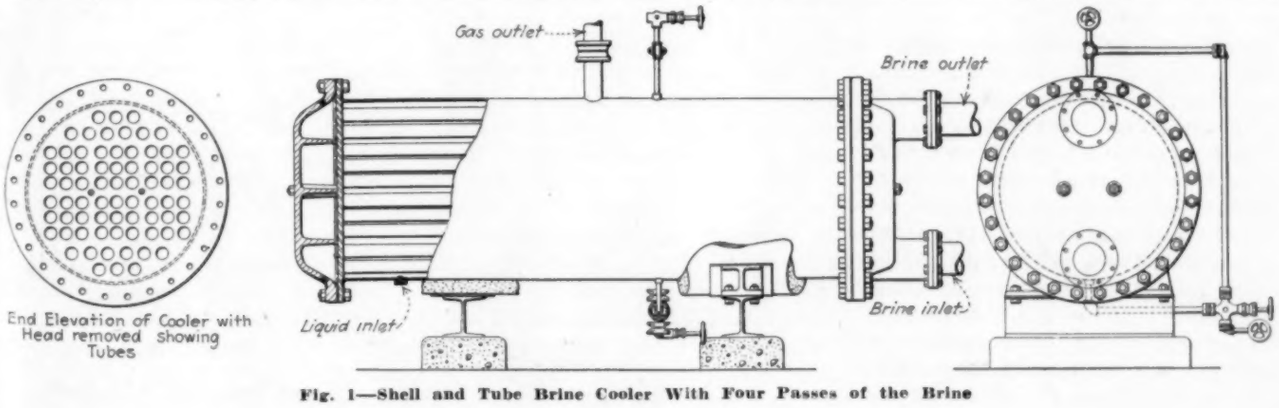


Fig. 1—Shell and Tube Brine Cooler With Four Passes of the Brine

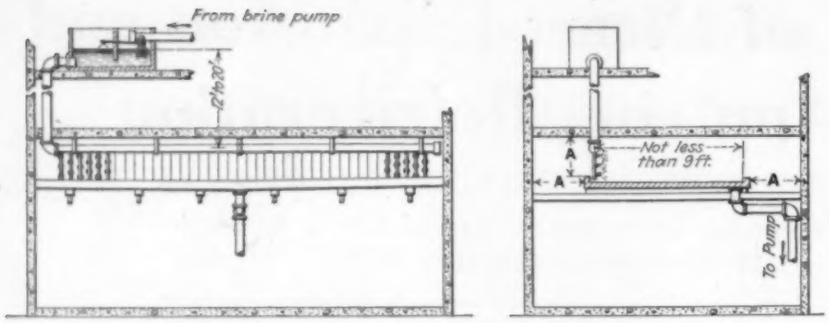


Fig. 2—Spray Cooling for Packing House Cooling Room

Press at Nozzle Lb. Sq.In.	Gallons Per Minute Webster ⅛ In. Open	Braemer No. 30	Carrier ⅛ In. Open
6	1.00	...	0.88
9	1.25	...	1.10
12	1.41	1.55	1.33
21	1.87	2.05	1.84
24	2.00	2.19	1.98
27	2.12	2.32	2.09
30	2.24	2.45	2.20
33	2.34	2.57	2.32
36	2.45	2.68	2.43
39	2.55	2.80	2.50

dew point temperature without the freezing of the moisture on the pipes. It has also been found that, in certain cases, a quicker and more satisfactory cooling of air can be obtained by a spray, because of the intimate contact that is thus established.

For instance, in a packing house where the hot carcasses must be cooled quickly, uniformly and with the least possible shrinkage in weight it has been found that the brine spray is the most suitable. The equipment is so designed that the entire air content of the room in which the hot meats are hung can be changed or recirculated every 1 or 2 minutes. The sprays drag the air in the direction of their flow and the nozzles are so placed as to make a curtain of spray through which the air must pass. It is thus cooled to the temperature of the brine or water. Water sprays are also widely used in cooling theaters and auditoriums, in chocolate and gelatine factories, and in other places where the desired temperature is not less than 35 deg. F.

In some industries ammonia cannot be used in the plant. Carbon dioxide is innocuous and can be used in such places, but it has not been widely adopted in the United States. In England and in northern Europe the condensing water is quite cool, and as a result CO_2 can be economically used as a refrigerant and is so used about half the time. In tropical countries such as India, however, the only condensing water available will have a temperature in the neighborhood of 100 deg. F. and in such cases sulphur dioxide or ethyl chloride may be successfully used.

Where ammonia leakage may cause considerable damage and, as in the case in many industrial plants, the grade of labor makes the likelihood of accident great, the indirect system with brine or water as the cooling agent is recommended. However, the indirect system is always more expensive to operate, especially as it requires an ammonia boiling temperature about 10 deg. F. lower than if direct ammonia expansion were employed. This is because of the double cooling required, although when sprays are employed the statement is not entirely correct. The brine has to be circulated, which heats it to an extent equal to the power used, and at times this item becomes important.

When using liquid ammonia in direct expansion, the liquid will pass to the expansion valve by its own pressure (due to the condenser pressure). The suction line, which is usually short, is designed so as to reduce the pipe friction loss to a minimum. It is usually necessary to keep the length of the suction return line short, so that when the compressor must be at a distance from the process where cooling is required, the brine system must be used.

When brine is used, care must be taken to avoid corrosion. All brine causes some corrosion, but neither commercial sodium chloride nor calcium chloride brine will cause much trouble if kept alkaline. There are a number of ways in which electrolysis may start. Among these are the mixing of different kinds of brine, the presence of carbon dioxide, the presence of air in solution in the brine and acidity of the brine. Equipment made of two or more metals—such as a brass agitator or galvanized fittings—will start galvanic action. The general opinion seems to agree that magnesium chloride mixed brine, though cheaper in first cost, readily becomes acid because of the unstable condition of the magnesium salt; and that the use of lime in order to get a basic reaction is not so successful when mixed brines are used.

In cooling brine there is a decided advantage in using the shell and tube brine cooler. When well designed and constructed it is simple, compact and durable, with large capacity and efficiency of surface, and small possibility of leaks developing. Generally, a surface of 14 to 15 sq.ft. per ton of refrigeration is used. The construction is similar to the steam surface condenser and the return tubular boiler. The diameter is usually from 48 to 54 in. and the shell thickness varies from ¼ to ⅞ in., depending on the diameter of the shell. The tube sheet is usually ½ in. thick. Tubes are usually of 2 in. nominal diameter. They are made of twelve-gage charcoal iron and are expanded into the tube sheet.

Cooler may be designed for a single pass of the brine, as is the case in installations where the cooler is submerged in the brine tank; or there may be many passes obtained by the use of baffles in the heads. As a rule, the number of passes should be kept down to six, for if the number of passes is excessive, resistance to flow becomes great and circulation therefore costly. Also, a high value of the coefficient of heat

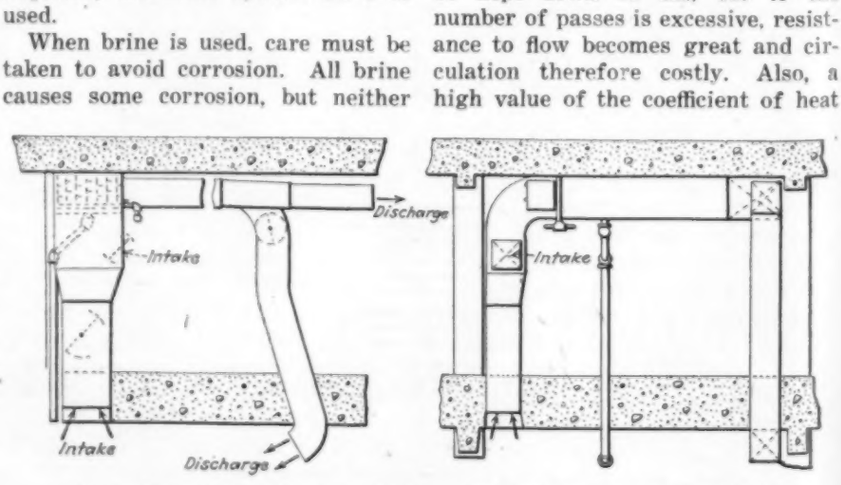


Fig. 3—Spray Cooling for Duct System. Overhead Sprays for Two Stories

transfer depends on the rapidity of flow of the brine through the tubes, and this flow is reduced by having too many passes.

Shell and tube coolers are popular, because the ammonia part may be made very self-contained. With the possible exception of the condensers (which are generally on the roof), the whole system may be in the compressor room under the eye of the engineer. With this cooler the ammonia charge is not so great and the pressure drop from the evaporator surfaces can be made almost inappreciable. Only one expansion valve need be used per cooler. The liquid is best carried at three-quarter level. A liquid trap can be placed in the suction line about 6 ft. above the top of the cooler to separate the liquid ammonia entrained in the suction gas, and this liquid can be returned to the cooler

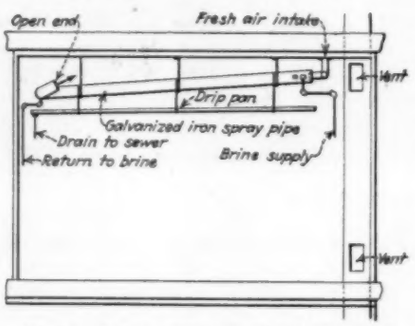


Fig. 4—Spray Brine Cooling for Small Room

through a pipe line using a goose-neck connection.

The advantages of the horizontal over the vertical shell and tube cooler are: The ammonia in the horizontal cooler does not have free passage out, as in the vertical type. The liquid priming is caught by the tubes, which are staggered somewhat. The headroom requirement is less, although more floor space is needed. Accessibility for repair is greater.

Shell and tube coolers should have connections at the top and bottom for the gage glass. There should be a blow-off outlet at the bottom and also a liquid ammonia inlet. A connection for gas outlet is provided at the top. With this type of cooler there is danger of freezing the brine and consequently bursting the tubes. For this reason calcium chloride brine should be used, because of its lower freezing point; and a careful check should be kept of the brine density. Even under these conditions, stoppage of brine circulation may cause trouble, if the boiling point of the ammonia is below the freezing temperature of the brine.

The design of brine piping systems is not very well standardized. The essential feature is to reduce the pumping cost to a minimum. This means the use of an expansion tank at the high point of the system and a piping arrangement so that the brine circulation in a complete cycle is of the nature of a siphon. Under such conditions the pump work is only the overcoming of the friction head. The static pressure on the pump is the sum of the friction head plus the head from the pump to the expansion tank.

Effects of Surface Film on Heat Transfer

In the course of a lecture on Feb. 14, 1924, before the Carnegie Institute of Technology, Pittsburgh, Pa., Prof. W. L. Badger, of the chemical engineering department of the University of Michigan, referred briefly to the film concept as it affects evaporator design. Some notes based on this portion of his lecture follow:

The most important single factor in the design of an evaporator, or a heater, or any one of many pieces of equipment used in the chemical industries, is its rate of heat transfer. It is gradually being recognized that we know less about heat transfer than about almost any other factor in engineering design; and yet, after strength of materials, there is probably no more important factor.

Heat transfer in ordinary cases is often confused with the thermal conductivity of the material through which the heat has to pass. For instance, it was said in the proceedings of an important association that since copper had seven times the conductivity of iron, replacing iron tubes by copper in an evaporator or heater should increase the capacity seven times. Actually, it increases the capacity only about 10 per cent.

This indicates that there is some factor in heat transfer for which we must look further. If we consider a plate of copper 1 ft. square and 0.065 in. thick (corresponding to 16 gage) the usual figures for the thermal conductivity of copper would indicate that there should flow through this plate, in one hour, with a temperature difference between the two sides of 1 deg. F., about 40,000 B.t.u. If this were an iron plate, it should pass about 6,500 B.t.u. under the same conditions. Actually, in designing an evaporator or a heater we have to figure on not more than 250 to 300 B.t.u., though we may reach 1,000 under unusual conditions.

Obviously there is some resistance other than the resistance of the metal itself. We know now that this resistance is a thin film of nearly stagnant liquid on the surface of the metal. Water and most liquids are very poor conductors of heat. We find, for instance, in the case of a copper plate, that if we assume a film of water 0.01 in. thick on each side of the plate, it will decrease the rate of heat transfer from 40,000 B.t.u. per square foot to about 300 B.t.u. Evidently, then, in commercial apparatus our problem is to get heat, not through a metal wall but through thin films of stagnant liquids. We must therefore know what factors affect the thickness of these films and how we can predict their resistance, either qualitatively or quantitatively.

Consider a tube with water on the inside and steam on the outside, and let us further consider the resistance that is offered to the flow of heat from the tube wall to the liquid. We find that the greater the velocity of the liquid the thinner the stagnant film. We find that the greater the viscosity the thicker the film. For a film of a given thickness we find that narrower tubes or denser liquids result in higher rates of heat transfer. These factors we can actually calculate numerically for a few limited cases which arise in practice. For the great bulk of practical cases we can predict only qualitatively what effect a given change in design may have.

On the steam side of the tube matters are much more complicated. The thickness of the liquid film is determined by the velocity of the steam and by the temperature at which the steam is condensing, since hot water is much less viscous than cold water. But the matter is also affected in ways that we do not fully understand, by the density of the steam, by the amount of air or other permanent gases in the steam, and possibly other factors.

This indicates that the rate of heat transfer is a very complicated thing and the question of what capacity a given apparatus will have is one that cannot be answered offhand. Further, in actual practice in some cases we will find one of these factors fixed for us by the service the apparatus must perform, while others will be left to the discretion of the designer.

Equipment News

From Maker and User

Service on Filtration Problems

The Celite Products Co., Chicago, Ill., is offering a unique service to those industries actively interested in the practical solution of difficult filtration problems. Three portable filtration units have been constructed and are available for experimental use in the New York, Chicago and Los Angeles industrial districts. These units are set up in the plant and used by Celite engineers to obtain data on the filtration problem in hand.

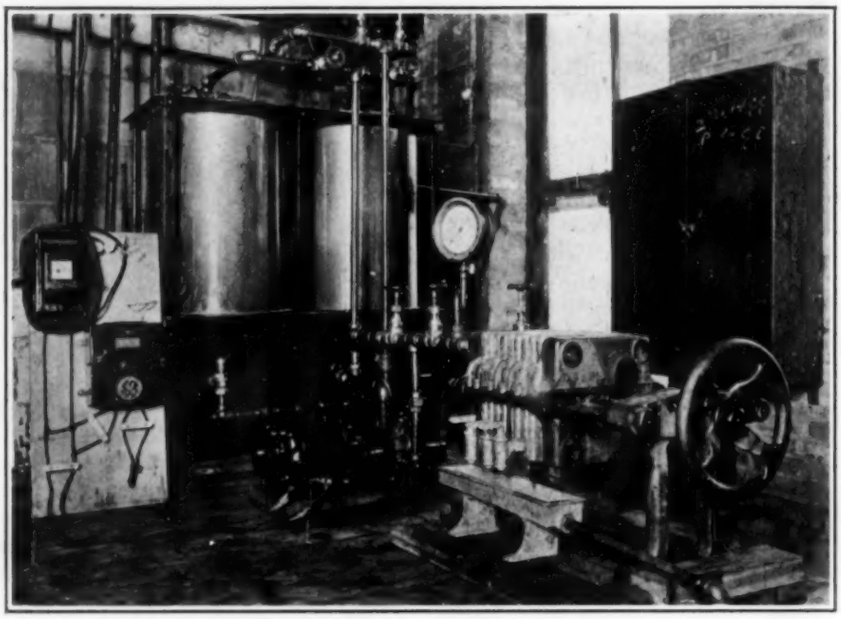
In designing the unit, shown in the illustration, flexibility of operation has received primary attention and an apparatus has been constructed that meets practically all the filtration requirements of a great variety of industries. The holding tanks are of tinned copper and all connections of tin-lined brass pipe. A rotary or gear pump driven by an a.c. or d.c. motor supplies power for the operation. The filter press, which completes the unit, is of the plate and frame type with aluminum plates designed for either open or closed delivery. A rotary blower with spider for air agitation and both open and closed steam coils are provided.

These units have been used in many plants and the experience thus gained has shown that the solution of filtration problems can be greatly expedited by experiments carried out on this semi-commercial scale. It has been found that the results obtained can be fairly accurately reproduced with the plant-scale equipment. The usual data collected are rates of filtration under varying conditions, the effect of Filter-Cel on clarity and rate, the general applicability of Filter-Cel and the economies attendant upon its use. Filtration problems in the following typical industries have been solved through the use of this experimental equipment and service: vegetable and paint oils, varnish, fruit juices, animal fats, glycerine, glue and gelatine, essences and extracts, pharmaceutical products, soap, sirups and sugar products and miscellaneous chemicals.

In addition to this service in the plant the company maintains filtration laboratories in New York and Los Angeles to which samples can be sent for preliminary experimental work. Both types of service are rendered free of charge to those actively interested in the solution of filtration problems.

A more detailed description of one of these units is given below:

Filter Press—Simple laboratory type of filter press complete with three aluminum plates and four aluminum frames, together with aluminum head plates, cocks and gutter. Total filter area 4 sq.ft. and total cake capacity ½ cu.ft. This press is piped for either open or closed delivery.



Filtration Experiment Unit

Tanks—Two 18x26-in. circular tinned copper tanks with 6 in. cone bottoms, supported on angle iron frame.

Coils—Two sets of ½-in. closed, tinned copper tubing formed into a coil for heating with steam. Two sets ½-in. perforated, tinned copper tubing formed into a coil for air agitation.

Pump—One bronze, gear type rotary pump with rated capacity of 4.4 gal. per minute at 0 lb. back pressure and 2.9 gal. per minute at 75 lb. pressure.

Blower—One rotary blower having a capacity of 12,000 cu.in. air per minute at 600 r.p.m.

Motors—One d.c. motor, 110 volt, ½ hp., 1,140 r.p.m. with rheostat. One a.c. motor, 110-220 volt, single phase, ½ hp., 1,140 r.p.m.

Gears—Cast-iron and fiber gears for motors, blower and pump.

Long-Lived Factory Fences

The development of a new process of galvanizing that trebles the life of woven wire fence has been announced by the Page Steel & Wire Co., of Bridgeport, Conn. The new method is called "galvanizing after weaving."

The process applies a protecting coat of zinc to the fabricated wire that is five times heavier than that of ordinary galvanized fence.

Formerly the wire of which fence was made was first galvanized and then woven into fence, and due to the fact that considerable mechanical operations were performed, the thickness of the zinc coating was definitely limited.

In the "galvanizing after weaving" method, the mechanical operations are all performed first, and the fabric is then galvanized, thus permitting the application of a "super-heavy" coating of zinc.

In service tests, wire bearing the thickness of coating that is applied by the new method has successfully withstood exposure in New England for more than 7 years. It is pointed out that inasmuch as the "galvanizing after weaving" method trebles the life of fence, it reduces service costs about two-thirds for the user.

Wood Rim Motor Pulley

The Dodge Manufacturing Corporation, of Mishawaka, Ind., announces a new iron center wood rim motor pulley. This pulley embodies the same principles of wood pulley construction that have been used in the Dodge wood split pulley and is a development of the Dodge idea of compression fastening and interchangeability of bushing to shaft used in the Dodge iron split pulley and the Oneida steel split pulley.

The hub construction is simple and wedge action is depended upon to secure fastening to shaft. There are two principal parts, the slit iron hub and the wood rim. The hub comprises a slit bushing, two wedge rings and three or more fillister head machine screws, according to the size of the hub. The wood rim is made of select stock, laid up in segments and glued under heavy pressure. A seamless

steel tube is forced into the wood rim and securely interlocked. This tube supports the rim and drives it through frictional contact with the wedge rings on the slit iron bushing.

The slit bushing is provided with a conical surface at both ends. When the screws are tightened, the wedge rings, which are also tapered, are brought together and become wedged between the steel tube in the rim and the slit bushing. The bushing is thus contracted on and held to the shaft by the wedge action of the rings.

The steel tubing provides a substantial backing for the wedge rings. The pulley is easily applied and by tightening the screws, gradually and uniformly, it is securely fastened. Removal is as easily accomplished and a screwdriver is the only tool required for both installation and removal. There are no set screws or keyways.

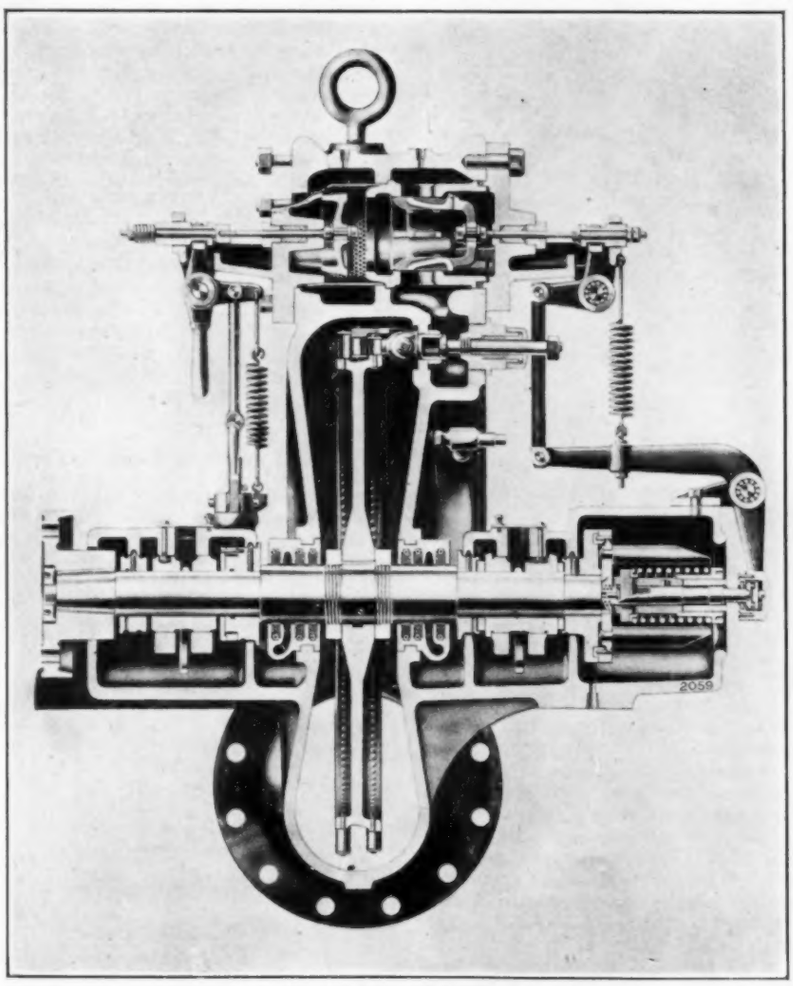
Turbine for High-Pressure Service

From many causes, and in particular the spread of the use of the non-condensing and bleeder type turbines, industrial plants have lately taken to generating steam at much higher temperatures than was formerly the case. This has made necessary the redesign of many steam-using appliances or else the use of desuperheaters and pressure-reducing valves. These latter are troublesome and costly and waste part of the available energy.

In the case of small turbines used for driving pumps, centrifugals and other similar equipment a more satisfactory solution is the employment of materials able to withstand the high temperatures and such an arrangement of parts that high temperatures are kept away from bearings and that expansion due to high temperatures cannot cause misalignment. These considerations, together with the desire to obtain compactness, simplicity and improved speed governing, have controlled the design of the new line of velocity stage turbines recently brought out by the De Laval Steam Turbine Co., Trenton, N. J.

The casing, as seen in the accompanying cut, is intended to be supported on a single pedestal at a point close to its center line. This permits the turbine to expand freely in all directions without affecting the alignment of the shaft. This shaft is supported on two bearings, one on each side of the housing and is connected to the driven machine by a flexible coupling. The wheel is a steel forging provided with an ample hub. It has two rows of buckets, as shown in the cut. These are of nickel steel. The bucket shanks pass through radial holes in the overhauling wheel rim and are riveted over on the inside. Shroud strips riveted on the outer ends of the buckets provide rigidity. Sufficient space is left between the ends of these strips to allow for expansion. The wheel is mounted on a heavy, rigid forged steel shaft and held in position by lock nuts. The stuffing boxes where the shaft passes through the walls of the housing are each fitted with three carbon packing rings, a space cored out between the outside and middle rings providing for steam sealing when operating under a vacuum.

Numerous other improvements, affecting the inlet nozzles, governor and over-speed governor have been embodied in the design. Parts are made to limit gages, to insure interchangeability. The sizes available run in convenient steps from 1 to 1,000 hp.



Section of Velocity Stage Turbine

Manufacturers' Latest Publications

Chicago Pneumatic Tool Co., 6 East 44th St., New York City—Bulletin 711. A catalog describing the Crescent vacuum pumps, which are now marketed by this concern.

Brown Instrument Co., Philadelphia, Pa.—A new book on pyrometry, entitled "Instructions for Installation and Care of Thermo-Electric Pyrometers," which is replete with useful facts for users of such equipment.

Midwest Air Filters, Inc., 100 East 45th St., New York.—A new catalog on the use and advantages of this type of air filter for air entering compressors and internal combustion engines.

McCord Radiator & Mfg. Co., Detroit, Mich.—Two new catalogs on McCord lubricators, one on the economies gained by good lubrication and the other on improved operation of locomotive cranes and steam shovels through good lubrication.

Brown Co., Portland, Me.—A catalog of the "Browne Valveless" pump, a vacuum lift for handling all types of pumpable liquid without passing it through the prime mover or through any valves.

Gasoline Recovery Corp., Charleston, W. Va.—A catalog of the charcoal process for the recovery of gasoline and other vapors from natural gas.

Andrews-Bradshaw Co., 530 4th Ave., Pittsburgh, Pa.—Bulletin 27. A new catalog of the Tracy oil vapor purifier, which is a system for removing all heavy liquids from the vapor stream in oil refineries.

Roller-Smith Co., 233 Broadway, New York City—Bulletin 110. A new bulletin on the type H D small portable direct current electrical instruments.

Celite Products Co., 53 West Jackson Blvd., Chicago, Ill.—Bulletin F-43-B. A new bulletin describing a method of clarifying cane sirup and remelt by filtration with Filter-Cel.

Graver Corporation, East Chicago, Ind.—A booklet consisting of survey by the A. C. Nielsen Co., of Chicago, describing the use of the Graver hot process water softener as used for softening the boiler feed water at the Independent Pneumatic Tool Co., of Aurora, Ill.

American Resistor Co., Milwaukee, Wis.—A leaflet on the Globar non-metallic electrical heating units.

Steere Engineering Co., Detroit, Mich.—Pamphlet 262. A leaflet on welded steel vacuum tubes.

American Blower Co., Detroit, Mich.—Bulletin 1613. A new bulletin giving description and specifications of the Ventura type disk fans.

Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.—Catalog 90. A new edition of this company's catalog on the Humo method for the heat-treatment of steel. This catalog is revised and enlarged from the last catalog issued on this subject.

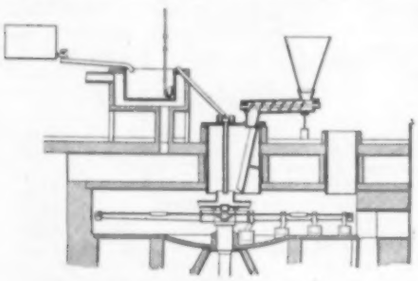
Columbus Machine Co., Columbus, Ohio—A catalog of "Hytest" forged steel valves for high-pressure service, such as is encountered in petroleum refinery work.

Celite Products Co., 53 West Jackson Blvd., Chicago, Ill.—Bulletin B-6E. A new descriptive bulletin on the subject of insulation for boilers, in which much information is given for those who desire to prevent heat leakage from such equipment.

Review of Recent Patents

Salt Cake and Hydrochloric Acid

In making salt cake from niter cake, the latter is usually pulverized and mixed with the salt. Caesar A. Grasselli, of Cleveland, suggests that substantial economies can be effected by feeding the niter cake in molten condition. The salt cake furnace shown is that described by Charles F. Guhlman in Patent 1,370,309, modified so as to permit feeding of molten niter cake. This flows directly from the niter pots to a heated storage reservoir above the



Salt Cake Furnace

salt cake furnace, the waste heat from the furnace being utilized to keep the niter cake molten. By means of a constant feeding device it is delivered to the hearth of the furnace, where it is mixed with salt fed in through a separate mechanism. The plows on the stirring arms are so arranged as gradually to work the charge toward the outer edge of the hearth, where the salt cake is discharged through a chute. Because of the continuous operation the capacity of the furnace is increased 60 to 70 per cent. (1,495,555, assigned to the Grasselli Chemical Co., Cleveland, May 27, 1924.)

Ferrochromium Furnace Brick

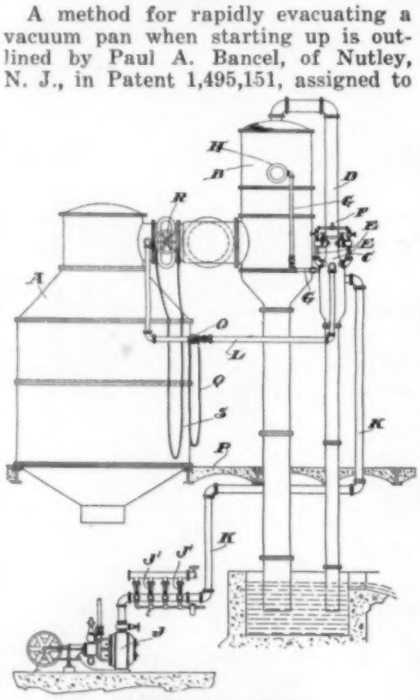
Certain ferro-alloys are highly resistant to corrosion by hot gases of an oxidizing nature or by molten zinc, tin, copper, lead, silver, antimony or bismuth and will not alloy with them when used to form or line retorts or other heat-resisting containers. The best known alloy of this character is an alloy of chromium and iron containing about 36 per cent chromium. As the casting of any relatively large body of such an alloy is an extremely difficult, costly operation, commercially impracticable, Edwin W. Hale, of New York, has developed the idea of casting the alloy into blocks or bricks. Retorts, furnace linings, etc., can be made by the use of these brick, which may be electrically butt-welded together, laid in high-temperature cement, or simply keyed together. (1,492,685, May 6, 1924).

Barium Chloride

On a dry basis the vat waste from the manufacture of barium sulphide contains about 35 to 40 per cent of barium calculated as sulphate and 8 to 15 per cent of combustible matter. Louis C. Drefahl, of Lakewood, and Charles H. Sakryd, of Cleveland, find that it is possible to recover barium chloride from this waste by treatment with calcium chloride. The waste is allowed to air-dry, mixed with an equivalent amount of fused calcium chloride and blast roasted in an apparatus similar to or operating on the principle of the Huntington-Heberlein pot or the Dwight-Lloyd sintering apparatus. The carbonaceous matter in the waste supplies all the fuel required. The sintered charge is leached, filtered, evaporated and crystallized, 75 to 80 per cent of the barium in the waste being recovered as chloride. Barium ores may be treated in the same way after adding the necessary amount of fuel. (1,495,893, assigned to Grasselli Chemical Co., Cleveland, May 27, 1924.)

Vacuum Pan

A method for rapidly evacuating a vacuum pan when starting up is outlined by Paul A. Bancel, of Nutley, N. J., in Patent 1,495,151, assigned to



Vacuum Pan Unit

Ingersoll-Rand Co., Jersey City, N. J., May 27, 1924.

A vacuum pan *A* of any suitable or usual construction is connected to a main condenser *B*, which is shown as a barometric condenser. An intercooler or intercondenser *C* is connected to the main condenser by the pipe *D* and primary augmenter jets *E* supplied with steam through the pipe *F* from a suitable source compress air and gases from the main condenser and discharge into the intercooler at a low vacuum. The intercooler is supplied with water by the pipe *G*, connected to the water supply pipe *H* of the main condenser. A vacuum pump *J*, or secondary jets *J'* connected to the intercooler by the pipe *K*, forms the second stage of the evacuating apparatus, as desired.

In accordance with this invention, the vacuum pan *A* is connected to the intercooler by the bypass pipe *L*, having an auxiliary controlling valve *O*, which may be manipulated by an operator from the floor *P* by means of the chain *Q*. A main controlling valve *R* in the main connection between the vacuum pan and the main condenser may also be manipulated independently by the chain *S*.

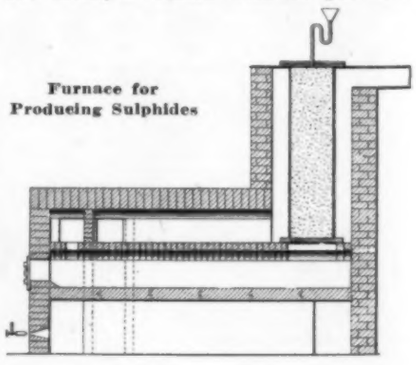
When it is desired to empty the vacuum pan, both valves *O* and *R* are closed. On starting the unit, the main valve *R* remains closed at first, and the auxiliary controlling valve *O* is first opened, connecting the vacuum pan directly with the intercooler *C* by means of the bypass *L*. The primary jets *E* of the evacuating apparatus are not used at this stage, but the pan is evacuated quickly by the vacuum pump *J* alone, or by the secondary jets *J'* if such are used, or by both secondary jets and the vacuum pump. Then the auxiliary controlling valve *O* is closed, and the primary jets *E* are started in operation and the main controlling valve *R* is opened and the apparatus is continued in operation as long as desired.

Reducing Sulphates With Hydrogen

Instead of reducing barium sulphate or sodium sulphate to the corresponding sulphide by heating with carbon, N. A. Laury, of Rockville Center, N. Y., effects the reduction by using hydrogen-containing gases derived, for example, from the thermal decomposition of mineral oil. The barytes, salt cake or other sulphate is placed on the floor of the oil-fired muffle shown, where it is heated to about 1,000 deg. C. Within the flue at the right is a chamber filled with granular calcined magnesite. Oil is fed in at the top of this chamber and is decomposed, forming a gas containing hydrogen without oxides of carbon, which are undesirable. This gaseous mixture reacts with the sulphate to form sulphide. (1,492,685, May 6, 1924.)

Joining Carbon Electrodes

Good electrical conductivity may be obtained in joining carbon electrodes by using the following paste: Amorphous graphite or carbon largely graphitized, ground so that 50 per cent passes 200 mesh and all goes through 100 mesh, is mixed with 20 per cent



Furnace for Producing Sulphides

of its weight of a mixture of one-third dehydrated tar and two-thirds pitch practically free from naphthalene. Clean cast-iron borings of not over 20 mesh are added in the proportion of about 15 per cent of the weight of carbon and the mixture is heated to 175 or 200 deg. C. The paste is applied to the hot electrode ends, the paste remaining thinly fluid at this temperature so that the joints are completely filled. Vents are provided at the end of the screw sockets to prevent trapping of air. Just before the joint reaches the furnace roof and current leads it is baked thoroughly by an electric heating jacket. (1,495,749, Bethune G. Klugh, of Chicago, assignor to Federal Phosphorus Co., Birmingham, Ala., May 27, 1924.)

Lead Sulphate Pigment

Lead sulphide ores are volatilized by being fed onto a series of electric arcs. Air is admitted above the arcs and the fume is thereby converted into sulphate of lead. Fine water sprays in a series of flues precipitate the fume to settling vats. Perforated steam coils in these vats warm and agitate the contents and sufficient sulphuric acid is added to convert sulphites and oxides into sulphates. Any excess of acid is neutralized with lime, the product settled, dried and packed. (1,495,410, James Gitsham and Harold R. Evershed, of Launceston, Tasmania, May 27, 1924.)

Readers' Views

A Paradox in Corrosion

To the Editor of Chem. & Met.:

Sir—In a paper entitled "A Paradox in Corrosion," published in your issue of June 16, Dr. U. R. Evans discusses two possible explanations of the currents produced by differential aëration. In support of the second explanation he presents experiments where he measures the amount of current developed by differential aëration. Dr. Evans finds that the current is increased when secondary electrodes of copper or silver are connected to the electrodes under test, and advances this fact in support of his theory.

One would naturally expect an increase in the current (without reference to Dr. Evans' theory) when the available area of contact between aërated solution and cathode is increased by connecting extra copper electrodes into the system. We know that the rate of corrosion is largely determined by the rate of oxygen diffusion to the electrode, and an increase in total electrode area should therefore increase the corrosion current.

Without disagreeing with Dr. Evans' proposed explanation, his experimental evidence does not appear to justify the statement, "This indicates the second mechanism (the nobler particles of the aërated area alone act as cathodes in the first instance) and it is concluded that current can be produced in both ways."

W. G. WHITMAN.
Massachusetts Institute of Technology, Cambridge, Mass.

U. S. Patents Issued June 17, 1924

Process of Treating Waste Sulphate Liquor and Compound Obtained Therefrom. W. H. Dickerson, Muskegon, Mich., assignor, by mesne assignments, to Industrial Waste Products Corp.—1,497,672.

Method for Producing Hydrocyanic Acid. O. Liebknecht, Frankfort-on-Main, Germany, assignor to Roessler & Hasslacher Chemical Co., New York.—1,497,690.

Dyestuffs Containing Sulphur and Process of Making Same. R. Herz, Frankfort-on-the-Main, and Norbert Steiger, Fechenheim, near Frankfort-on-the-Main, Germany, assignors to Leopold Cassella & Co., Gesellschaft mit beschrankter Haftung. —1,497,720.

Process and Apparatus for the Production of Phosphoric Acid. Bethune G. Klugh, Anniston, Ala., assignor to Federal Phosphorus Co., Birmingham, Ala.—1,497,727.

Circulatory Process and Apparatus for Catalytically Treating Materials. Ernest Hopkinson, New York.—1,497,751.

Tire-Vulcanizing Apparatus. Ernest Hopkinson, New York.—1,497,752.

Process of Flattening Glass Sheets. Harry G. Slingluff, Mt. Vernon, O., assignor to Pittsburgh Plate Glass Co.—1,497,798-9.

Process of Corrugating Pulpboard. Daniel M. Sutherland, Jr., Trenton, N. J., assignor to Agasote Millboard Co., Ewing Township, N. J.—1,497,809.

Material-Handling Apparatus. Warren Travell, New York.—1,497,813.

Catalyst. Wallace B. Van Arsdel, Berlin, N. H., assignor to Brown Co., Berlin, N. H.—1,497,815.

Process of Making Acetone and Other Ketones. Alfred A. Wells, Montclair, N. J., assignor, by mesne assignments, to Seth B. Hunt, trustee, Mt. Kisco, N. Y.—1,497,-817.

Pressure Regulating Mechanism for Wood-Grinding Machines. Frank A. Peschl, Bern, Switzerland, assignor to International Paper Co.—1,497,870.

Pectin Product and Process of Producing Same. Eloise Jameson and Francis N. Taylor, Corona, and Clarence P. Wilson, Pomona, Calif., assignors to California Fruit Growers Exchange, Los Angeles, Calif.—1,497,884.

Glass-Boring Device. Neil T. Albright, Kokomo, Ind.—1,497,887.

Chemical Heater. Paul L. Berkey, Zelienople, Pa., assignor of one-half to Robert C. Roy, Pittsburgh, Pa.—1,497,970.

Therapeutically Valuable Compound of Hexamethylenetetramine. Eugen Sonnenfeld and Arthur Stoll, Basel, Switzerland, assignors to Chemical Works formerly Sandoz, Basel, Switzerland.—1,497,995.

Process for the Manufacture of Detonating Compositions for Detonators or Primers. Edmund von Herz, Charlottenburg, Germany.—1,498,001.

Lubricant for Refrigerating Machines. Harry D. Edwards, Larchmont, N. Y., assignor to Carbide & Carbon Chemicals Corp.—1,498,021.

Apparatus for the Production of Concentrated Nitrous Gases. Birger Fjeld Halvorsen, Christiania, Norway, assignor to Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Christiania, Norway.—1,498,030.

Process for the Production of Ammonia. Birger Fjeld Halvorsen, Christiania, Norway, assignor to Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Christiania, Norway. —1,498,031.

Process for the Commuting of Smokeless Powder of the Nitrocellulose Type. Gerald H. Mains, Detroit, Mich., and Fred B. Stieg, Chevy Chase, Md.—1,498,053.

Process of Receiving Volatile Fluids. John C. Bertsch, Tulsa, Okla., assignor to Bertsch Process Co., Wilmington, Del.—1,498,069.

Alloy Steel. W. Norman Bratton, New York, assignor to Climax Molybdenum Co., New York.—1,498,071.

Apparatus for Mixing or Beating Plastic Materials. James J. Finney, Muskegon, Mich., assignor to Albert G. Dickinson, Grand Rapids, Mich.—1,498,084.

Apparatus for Separating Gases From a Mixture Thereof. Gustav L. Herz, Eindhoven, Netherlands, assignor to Maamlooze Vennootschap Phillips' Gloeilampenfabrieken, Eindhoven, Netherlands.—1,498,097.

Suspension of Electrode Plates in Electric Accumulator Cells. Fernand Van de Wiel, Paris, France, assignor to Compagnie Générale d'Electricité, Paris, France.—1,498,136.

Centrifugal Pipe Mold. Clinton E. Wilder, Irvine, Pa.—1,498,138.

Roller Grizzly. Colby M. Avery, Aurora, Ill., assignor to Stephens-Adamson Mfg. Co., Aurora, Ill.—1,498,144.

Recovering Sulphur Trioxide. Norman C. Hill, St. Louis, Mo.—1,498,168.

Separator. Lycurgus Lindsay, Los Angeles, Calif.—1,498,181.

Method of and Apparatus for Marbling Paper. Frederic Payson Reed, East Orange, N. J., assignor to Charles C. Orcutt. —1,498,200.

Reversible Agitating Apparatus for Fluids. Noah Walker, Philadelphia, Pa.—1,498,217.

Method of Heating Vulcanizers. Herbert Addison Woofter, Swampscott, Mass., assignor to Thomson Electric Welding Co., Lynn, Mass.—1,498,222.

Purifying and Deodorizing Isopropyl Alcohol. Hyym E. Buc, Roselle, N. J., assignor to Standard Development Co.—1,-498,229.

Machine for Surface Finishing Paper and Similar Materials. A. Millard Daniels, Adams, Mass.—1,498,237.

Adhesive Material. John J. Harris, Harding, Mont.—1,498,269-70.

Art of Preparing Pure Ethyl Hydroxide. Herman Heuser, Evanston, Ill.—1,498,274.

These patents have been selected from the latest available issue of the "Official Gazette" of the United States Patent office because they appear to have pertinent interest for "Chem. & Met." readers. They will be studied later by "Chem. & Met.'s" staff, and those which, in our judgment, are most worthy will be published in abstract.

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

Filter Press and Filter Plate Therefor. Charles C. Ahlum, Chester, Pa., assignor to E. I. du Pont de Nemours & Co., Wilmington, Del.—1,409,313.

Process for Dyeing Acetyl Cellulose. James Braddiley and James Hill, Manchester, and Edward Bertram Anderson, Hemyock, near Tiverton, England, assignors to British Dyestuff Corp., Ltd., Manchester, England.—1,498,315.

Blue Trisazo Dyes. William W. Bauer, Thurston, O., and Harold W. Woodward, Pennsgrove, N. J., assignors to E. I. du Pont de Nemours & Co., Wilmington, Del. —1,498,316.

Apparatus for the Production of Powdered Material. Claude A. Bulkeley, Wilmington, Del., assignor to E. I. du Pont de Nemours & Co., Wilmington, Del.—1,498,318.

Evaporator. Evi W. Christie, Sewaren, N. J., assignor to Wheeler Condenser & Engineering Co., Carteret, N. J.—1,498,350.

Evaporator. Francis M. Hartman, Earleton, Fla.—1,498,372.

Process of Making Friction Facings. Lester Kirschbraun, Chicago, Ill., assignor to Raybestos Co., Bridgeport, Conn.—1,498,386.

Emulsion and Process of Making Same. Lester Kirschbraun, Chicago, Ill.—1,498,387.

Method of and Means for Treating Liquids. Harry E. La Bour, Chicago, Ill., assignor to Chemical Equipment Co., Chicago, Ill.—1,498,389.

Apparatus and Process for Producing Combinations of Gases. Karl B. McEachron, La Fayette, Ind., assignor to Trustees for Purdue University—1,498,393.

Tanning Material and Process of Making It. Otto Schmidt and Heinrich Ulrich, Ludwigshafen-on-the-Rhine, Germany, assignors to Badische Anilin & Soda-Fabrik, Ludwigshafen-on-the-Rhine, Germany. —1,498,403.

Azo Dyestuffs Insoluble in Water and Process of Making Same. Arthur Zitscher and August Leopold Laska, Offenbach-on-the-Main, Germany, assignors to Chemische Fabrik Griesheim-Elecktron, Frankfort-on-the Main, Germany.—1,498,417.

Books Received

English Rubber Year Book

SECOND YEAR BOOK OF THE INSTITUTION OF THE RUBBER INDUSTRY, 1923. 448 pages. Published by the Institution of the Rubber Industry, 10 Charing Cross Road, London, W. C. 2. Price, 5s.

In addition to such general information as officers, committees, membership and annual reports, the book contains 434 pages of text, covering in full the papers and discussions presented during the session 1922-1923. There are in all 23 papers, covering a wide range of topics of interest to the industry, as will be evident from the following partial list: Rubber Latex in Paper-Making, by F. Kaye; Reclaimed Rubber, by J. Torrey; Recent Plantation Developments, by H. P. Stevens; Rubber Manufacturing Difficulties; Science in the Rubber Industry, by B. D. Porritt; Technology, by W. A. Williams; Review of Solvent Recovery Processes, by J. H. Wild; Rubber Latex, by H. P. Stevens; Pigments, by D. F. Twiss; Mechanical Problems, by P. J. Burgess; Present State of Industry, by W. C. Geer. The volume is a splendid illustration of enthusiastic interest in problems of rubber technology and trade.

Progress of Applied Chemistry

REPORTS OF THE PROGRESS OF APPLIED CHEMISTRY, Vol. VIII, 1923. 600 pages. Published by the Society of Chemical Industry, London. Price, 12s. 6d.

In chapters averaging twenty pages each, the year's record of achievement for twenty-four branches of applied chemistry is presented from the viewpoint of specialists. The grouping of industries follows the plan used in the abstract section of the *Journal* of the society. The preparation of these reviews and their early publication involves an immense amount of work, and the editor and contributors are to be congratulated for their efforts in placing before chemical technologists this timely summary of industrial development.

Pumping Chemical Materials

MODERN THEORY AND PRACTICE OF PUMPING. By *Norman Swindin*. 355 pages, 281 illustrations. Ernest Benn, Ltd., London. Price, 42s.

In studying pumping problems, chemical engineers have hitherto been handicapped by the fact that the standard reference works, although excellent, dealt almost entirely with water. The liquids handled in chemical plants differ so much from water and from one another that rational modification of the hydraulic formulas is difficult.

Mr. Swindin devotes the first part of his book, about 100 pages, to a discussion of the flow of fluids, particularly emphasizing the importance of the Reynolds-Stanton curve of viscous flow.

Part II is by far the most exhaustive treatment available of types of equipment for handling the liquid materials of the chemical industries. Rams, centrifugals, rotary pumps, the air lift, displacement pumps and other special types are considered from the viewpoint of the chemical engineer.

Processing Fruits and Vegetables

COMMERCIAL FRUIT AND VEGETABLE PRODUCTS. By *W. V. Cruess*, assistant professor of fruit products, University of California. 530 pages, illustrated. McGraw-Hill Book Co., New York. Price, $4.50.

In view of the fact that intelligent application of scientific principles to the processing of fruit and vegetable products has been comparatively recent, the progress as revealed in this book is little short of amazing. The variety of products prepared on a commercial scale is likewise astonishing. The canning industry holds first place, of course, but there are also sirups, preserves, unfermented beverages, dehydrated fruits and vegetables, vinegar, pickles and innumerable byproducts. Each branch has a highly developed technology and it is of great value to the technical man and manufacturer to have these all brought together.

Eminent American Chemists

EMINENT AMERICAN CHEMISTS. Compiled and edited by *D. H. Killeffer*, associate editor, *Industrial & Engineering Chemistry*. Published by D. H. Killeffer, 19 East 24th St., New York. Price, $6.

With the idea of making available likenesses of distinguished American chemists, the editor of this portfolio has reproduced portraits of thirty-three chemists, together with brief sketches of the outstanding work of each. The portraits and sketches are on separate sheets, the entire set being in an attractive loose-leaf binder so that any portrait may be removed for framing, if desired. The complete set is as follows:

L. H. Baekeland, W. D. Bancroft, B. B. Boltwood, J. C. Booth, C. F. Chandler, R. H. Chittenden, F. W. Clarke, F. G. Cottrell, Josiah P. Cooke, E. C. Franklin, J. Willard Gibbs, Wolcott Gibbs, Moses Gomberg, Robert Hare, W. F. Hillebrand, T. Sterry Hunt, Irving Langmuir, G. N. Lewis, J. W. Mallett, E. W. Morley, A. A. Noyes, W. A. Noyes, Joseph Priestley, Ira Remsen, T. W. Richards, Count Rumford, Benjamin Silliman, Sr., Edgar F. Smith, J. Lawrence Smith, Julius Stieglitz, Donald D. Van Slyke, W. R. Whitney, H. W. Wiley.

New Publications

THE FIFTH EDITION of the Refractories Manufacturers Association's "Book of Brands" will be ready for distribution soon. In addition to a complete list of manufacturers of firebrick in this country and in Canada, it gives an alphabetical list of the brands and trademarks used in the industry. In this new edition the manufacturers' names are also grouped by states, which makes it a convenient reference book. Copies may be obtained without charge by application made to Frederic W. Donahoe, secretary, 2202 Oliver Bldg., Pittsburgh, Pa.

THE UNIVERSITY OF ILLINOIS, Urbana, Ill., has issued Bull. 142, Engineering Experiment Station, on "An Investigation of the Fatigue of Metals" by H. F. Moore and T. M. Jasper.

Important Articles in the Technical Literature

"Manufacture and Uses of Glycerine." *Anon.* Properties and commercial production in Great Britain. *Chemistry & Industry*, June 6, 1924, pp. 586-9.

"Chemical Engineering at the British Empire Exhibition." *J. W. Hinchley.* The first of a series of descriptions of new equipment. *Chemistry & Industry*, June 6, 1924, pp. 591-5.

"Graphical Chart for Determining Excess Air in Combustion of Producer Gas." *Gordon M. Peltz.* Copies of this chart may be obtained from the author at Corning Glass Works, Corning, N. Y. *Journal* American Ceramic Society, June, 1924, pp. 437-443.

"Insulating Glass Tanks." Discusses the practical investigations made by W. K. Brownlee, of the Buckeye Clay Pot Co. *Ceramic Industry*, June, 1924, pp. 349-352.

"Use of Rotary Spraying Booth at Enamelware Plant." Describes the modern plant of the Chicago Vitreous Enamel Product Co. *Ceramic Industry*, June, 1924, pp. 353-357.

"New $1,000,000 Pottery." Description of Homer Laughlin China Co.'s new plant for semi-vitreous dinner ware. *Ceramic Industry*, June, 1924, pp. 360-68.

In Foreign Technical Literature

"Is the Fertilizing Power of Chilean Saltpeter Affected by the Iodine Content and by Any Alleged Radioactivity of Saltpeter?" *Hj. von Feilitzen and H. Egner.* Claims that Chilean saltpeter is superior to the synthetic product ($NaNO_3$) are not yet substantiated and should not be too readily accepted. *Chemiker-Ztg.*, May 17, 1924, pp. 325-6.

"Sewage Purification With Chlorine." *Bach.* The chlorinating plant at Essen is obtaining promising experimental results in sewage purification, using the Ornstein equipment and method (liquid chlorine). *Wasser und Gas*, 1923, pp. 1109-38; *Chem.-techn. Uebersicht*, May 17, 1924, p. 85.

"The Chemical Industry in Soviet Russia." A statistical review, showing the status and progress of chemical industry in Russia since August, 1921, when the Soviet policy of making industry independent of the state except in ownership was put into effect. *Chem. Ind.*, April 26, 1924, pp. 195-7.

"World Production of Sulphur." A statistical review. *Chem. Ind.* May 17, 1924, pp. 244-5.

"Utilization of Pines." *W. Schultze.* Attempts to supply the German rosin market from domestic production have not been very successful, although the enterprise apparently had excellent prospects. *Chem. Umschau.*, 1923, pp. 144, 151; *Chem.-techn. Uebersicht*, May 10, 1924, p. 83.

News of the Industry

Summary of the Week

Treasury Department has issued supplemental list of standards of dyes for the purpose of appraising imports.

Dr. F. E. Breithut will be available to trade organizations wishing to discuss the chemical industry in Europe.

Announcement of agreement on sale of dyes between Grasselli and Bayer companies revives rumors of further German-American combinations in dye trade.

Tariff Commission holds final hearing in connection with investigation into production costs of casein and orders briefs filed by July 10.

Dr. Leo H. Baekeland made a Commander of the Order of Leopold by King Albert of Belgium.

Interstate Commerce Commission has ordered a cut in freight rates on shipments of naval stores from Southern producing points.

Varied programs carried out at annual meeting of the American Society for Testing Materials held last week at Atlantic City.

Government files suit against mineral oil companies, alleging conspiracy to violate the Sherman anti-trust law.

Grasselli and Bayer Companies in Dye Agreement

Varying views are expressed in Washington regarding the announcement that the Grasselli Dyestuffs Corporation, a recently formed subsidiary of the Grasselli Chemical Co., of Cleveland, organized to operate the color plants of the parent corporation, had become the sole importer of dyestuffs manufactured by the German firm of Bayer & Co. Keen interest was expressed in the announcement in view of previously published rumors in various newspapers that the Bayer company had purchased the dye plants of the Grasselli company in this country, which was coupled with the further rumor that the H. A. Metz dye plants in the United States had been sold to Farbwerke Hoechst, of Germany. Reports of these sales were promptly denied by Mr. Metz and officials of the Grasselli company and also by representatives of the German firms named.

The Bayer company is one of the "big four" of the German cartel. It was a powerful factor in the United States prior to the war, when its American patents and other property were seized under the alien property act and subsequently most of them were disposed of to the Grasselli Chemical Co.

The announcement by the Grasselli company at its Cleveland offices of its relationship with the Bayer company as sole importer apparently disposes of this phase of the previous rumors for the time being at least. Mr. Metz has denied any sale of his properties to the Hoechst concern, another of the German "big four," and has explained that the rumor probably grew from the fact that on a recent visit to Germany he made arrangements to secure the co-operation of technical experts from this concern in his operations here.

Washington observers are watching further developments, not as related to these two domestic corporations but rather with an eye toward possible importing connections between other domestic dye plants and German concerns. It is pointed out in some quarters that there may be a certain danger to the full development of the domestic dyestuffs industry by arrangements whereby a domestic producer becomes the importer for a foreign concern. If a satisfactory profit is made from imported goods, it is felt by some that the tendency to expand costly research toward development of new colors may be halted through removal of the incentive. In other quarters a new form of German invasion is predicted, with a situation resulting whereby, through agreements of one sort or another, the tariff wall will be overriden; if the tariff is so high as to exclude German-made products, because of high price, then the products may be made here, or if the tariff is low, then the products may be made in Germany at low labor cost, and imported into the United States.

Additions Made to List of Standards of Dyes

The Treasury Department has issued a supplemental list of standards of dyes for the purpose of appraising imports, which is to be added to the revised list issued several weeks ago. It is the intention of the department to issue further supplemental lists as experience and experiment justify. The lists are in accordance with that proviso of paragraph 28 of the tariff act, which stipulates that the specific duty of 7c. a lb. on coal-tar products shall be assessed in proportion to the commercial strength of similar imports prior to July 1, 1914. Many dyes are now being imported in higher concentrations than prior to the World War.

Dr. Baekeland Honored by King of Belgium

Dr. Leo Hendrik Baekeland, president of the American Chemical Society and professor of chemical engineering in Columbia University, has been made a Commander of the Order of Leopold by King Albert of Belgium. Dr. Baekeland, one of the foremost figures in American chemistry, is internationally known for his invention of Bakelite. He is a member of the Naval Consulting Board, of the Nitrate Supply Commission, of the administrative board of the Institute of International Education, and of the committee on patents of the National Research Council, of which he is chairman.

Dr. Baekeland was awarded the Nichols medal of the American Chemical Society in 1909, the John Scott medal of the Franklin Institute in 1910, the Willard Gibbs medal of the Chicago Section of the American Chemical Society in 1913, the Chandler medal of Columbia University in 1914, the Perkin medal for industrial chemical research in 1916, and the grand prize of the Panama-Pacific Exposition in 1915.

Dr. Baekeland, now president of the General Baekelite Co., has been a member and an officer of numerous learned societies both here and abroad. He has been granted many patents and is the author of various publications relating to chemistry and allied fields.

Dr. Parr at Ithaca Meeting

At the Ithaca meeting of the American Chemical Society the Gas and Fuel Section will hold a round-table discussion on the "Storage of Coal and Spontaneous Combustion." Dr. S. W. Parr of the University of Illinois will lead the discussion. The Gas and Fuel Section will be pleased to hear from any one who has material to present.

Corrosion Symposium High Spot at A.S.T.M. Meeting

Atlantic City Convention Well Attended—Fundamental Properties of Materials Attract Attention

The twenty-seventh annual meeting of the American Society for Testing Materials, held during the past week at Chalfonte-Haddon Hall, Atlantic City, was marked by several sessions of unusual interest to the chemical engineer. One of the principal themes of the meeting had to do with heat- and corrosion-resistant metals. Both the papers presented and the discussion resulting are to be abstracted in *Chem. & Met.* for July 7. In addition to these sessions dealing with metals, the usual reports were made by the committees dealing with standard specifications. Among others these included rubber, petroleum, lime, gypsum, cement, insulating materials, paint and varnish. In general indications were for active continuation of the work that has been carried on during the past year.

Following the presidential address by Guilliaem Aertsen on Wednesday evening devoted to the topic "What Is Steel?" the annual informal dance was held. On the same evening announcement was made of the following officers for the coming year: President, F. M. Farmer; vice-president, J. H. Gibboney; secretary-treasurer, C. L. Warwick; executive committee, William Campbell, A. E. Jury, John A. Matthews and Anton Marston.

Fourteen Sessions Held

Fourteen sessions were scheduled during the week in addition to the usual numerous committee meetings. These included a two-session symposium of twelve papers on corrosion-resistant, heat-resistant and electrical resistance alloys under Chairman Guilliaem Aertsen, who also presided at a session on steel. W. M. Corse acted as chairman of a six-paper session on coal, timber, rubber and textiles. J. H. Gibboney was in charge of a session of seven papers and much discussion on paints, petroleum products, insulating materials and thermometers. Considerable attention was devoted to the corrosion and metallography of non-ferrous metals in a session of six papers over which G. H. Clamer presided. At the meeting devoted to lime, gypsum and ceramics under A. T. Goldbeck the principal action taken was with regard to simplification of chemical lime specifications making the CaO content the principal index of quality. F. M. Farmer, who presented a report at an earlier session on tests for electrical insulating materials, was chairman of the session devoted to road and paving materials and waterproofing, consisting of five reports. Methods of testing and nomenclature engaged considerable interest, with seven papers given in a session under Vice-President W. H. Fulweiler.

Six papers were devoted to magnetic analysis and fatigue of metals in a session presided over by J. A. Capp. Cement and concrete, including reinforced concrete, required two sessions and included eleven papers. George S. Webster and Cloyd M. Chapman were in charge of these. Wrought and cast iron discussion filled a session built around six papers.

A prevailing note was to be found in the increased interest generally in research that will develop better knowledge of the fundamental properties of materials. In the more complete report of this meeting, exclusive of the corrosion symposium, to be published in an early issue of *Chem. & Met.*, further evidence of this point will appear.

New Series of Dyes Produced From Spruce Turpentine

Extremely interesting and what may prove invaluable research on the utilization of a hitherto wasted byproduct has recently been completed by Dr. A. S. Wheeler, of the department of chemistry of the University of North Carolina.

The research has to do with the production of new dyes from spruce turpentine, which is a byproduct of spruce wood when used in the manufacture of paper. The raw materials for the research work were furnished by the pulp mills of North Carolina.

The turpentine from the spruce comes from the great wood digesters at the pulp mills as a very dark brown liquid and customarily is thrown away as a waste. The turpentine, however, is composed very largely of one substance, cymene. In his work Dr. Wheeler added bromine, the cymene, and this product in conjunction with such coal-tar products as phenol, resorcin and beta naphthol was then used to produce a new series of dyes. Twelve new dyes in all were made, and a beautiful series of colors was obtained. These included yellow, peach, scarlet, orange red and wine red.

In the experiments the fastness of the new dyes to light was made a subject of severe tests, which they stood admirably, being exposed to sunlight for considerable periods of time without fading, being thus proved to be very fast to light. The dyes produced are suitable for dyeing silk and wool. They are not satisfactory for use on cotton goods.

Final Hearing in Investigation of Casein Production Costs

A final hearing in connection with the investigation into costs of production of casein was held by the Tariff Commission on June 23. In this case coated paper manufacturers had applied for a decrease in duty. A hearing was held last fall and the facts developed there led the commission to reopen its field inquiry in an effort to secure figures on costs of producing whole milk.

Little testimony outside of technical information on butter fat content of milk under varying conditions was introduced at the final hearing, most of the day being devoted to arguments by the opposing sides as to the proper method to be followed by the commission in determining costs of casein, three suggested methods being put forward by the commission. In behalf of the applicants, H. A. Wise, appearing as attorney, advocated that the commission adopt the suggested method of allocating the cost of whole milk to casein in the ratio that the sales value of casein bears to the sales value of all products produced from the whole milk. This is a method apparently favored by the Chemical Division of the Tariff Commission, as it appears to take into account all of the economic factors affecting the industry in this country and in Argentina, which is the principal competing country. Other possible methods suggested were to assume that the value of skimmed milk as determined by manufacturers in the United States is correct and that the value in Argentina bears the same ratio to the domestic value as do the prices of the whole milk in the two countries, and, further, as a third suggestion, assume that the domestic industry makes only the products, butter and casein, made by the Argentine industry and allocate the cost of whole milk on the ratio of the sales value of casein and butter alone.

The domestic interests, represented by A. M. Loomis, of the National Dairy Union, and other representatives of dairy organizations, assume no positive stand as to the method to be followed in determining costs, but interpose no objection to that of allocating value of all products.

In an effort not only to justify the existing tariff duty but to show that even greater protection is necessary in order to develop adequately the domestic casein industry, several witnesses were introduced by the interests opposing a reduction, who testified along technical lines. They included Charles E. Sniffen, of the Dairymen's League, New York; W. H. Bronson, of the New England Milk Producers Association; L. A. Rogers, chief of the laboratory of the Dairy Division, Department of Agriculture, and William White, also of the Department of Agriculture.

The opposing sides were given until July 10 to file briefs in the case.

Funds Donated for New Science Building for Kenyon College

At the centennial commencement of Kenyon College, Gambier, Ohio, held last week, it was announced that H. G. Dalton, managing director of Pickens, Mather & Co., Cleveland, O., had donated to the college funds for a new science building. While no amount was specified in the gift, the cost of the building and equipment will be approximately $200,000. Mr. Dalton stipulated that the new building should be named Samuel Mather Hall in honor of Samuel Mather, who has been the principal benefactor of the college for 10 years.

Naval Stores Men Meet to Form Exporting Company

Twenty naval stores operators from Lowndes, Berrien, Clinch, Echols and Brooks Counties met in Valdosta, Ga., recently, with E. A. McKoy, of New Orleans, field agent, to consider the organization of the Turpentine and Rosin Exchange, a $2,000,000 naval stores exporting corporation. Dr. E. P. Rose, dean of the south Georgia operators, presided.

Washington News

Anti-Trust Charges Against Oil Companies

U. S. Attorney General Stone, in the District Court of Chicago, last Wednesday started anti-trust proceedings against about 50 oil concerns which he charged with operating in violation of the Sherman anti-trust law. Legal action followed lengthy investigations conducted by the Department of Justice and the Federal Trade Commission. The primary defendants are the Standard Oil Companies of Indiana and New Jersey, the Standard Development Co., the Texas Co., and the Gasoline Products Co. In addition the following were named as secondary defendants: Standard Oil Companies of California, Kansas, Kentucky, Louisiana, New York and Ohio, and the Aetna Refining Co., the American Refining Co., the Beacon Oil Co., the Clayton Oil & Refining Co., Charles F. De Ganahl, Galena Signal Oil Co. of Texas, Globe Oil & Refining Co., Graysburg Oil Co., Hickock Producing Co., Humble Oil & Refining Co., the Imperial Co., Ltd., Indian Refining Co., Industrial Refining Co., Indiahoma Refining Co., Interstate Refineries, Elliott Jones & Co., Lion Oil & Refining Co., Magnolia Petroleum Co., Miller Petroleum Co., Omaha Refining Corporation, Owl Oil Co., Petroleum Refining Co., Producers Pipe Line & Refining Co., Pure Oil Co., Root Refineries, Roxana Petroleum Corporation, Sapulpa Refining Co., Southern Oil Corporation, Sun Co., Tidal Refining Co., Tide Water Oil Co., United States Oil & Refining Co., Utah Oil Refining Co., Vacuum Oil Co., Waite Phillips Co., Waverly Oil Works, and the White Eagle Oil & Refining Co.

While the investigations of the government bodies are said to have been partly to ascertain whether the Standard Oil companies had violated the dissolution order which was issued against them in 1911, the main point in the present action appears to be concerned with the pooling of patents covering cracking processes. According to an announcement made in the publication of the Standard Oil Co. of New York, in December, 1923, the Standard Oil Companies of New York and Indiana, the Texas Co. and the Gasoline Products Co. held patents which were found to overlap and concerning which disputes had arisen among the companies mentioned. These disputes were amicably settled by an agreement through which these companies were granted the interchange and use of the patented processes in question.

The federal citation states that: "In line with the decision of the Supreme Court in the so-called bathtub case, the Attorney General charged that the provisions of the various license agreements go beyond what is necessary to protect any legitimate rights of the defendants, even assuming the validity of their assorted patent rights. But the petition does not concede the validity of such rights, and allege that the procuring and treating of such patents as valid 'is but a device to lend color of legality to the combination, conspiracy and monopoly.'"

Attorney General Stone also charges that: "Seventy-nine license agreements are set up as constituting and evidencing the combination, conspiracy and monopoly. These agreements contain numerous provisions affecting adversely the production, transportation and sale of gasoline, kerosene, naphtha and other products in interstate and foreign commerce.

"The effect of these agreements has been to pool a large number of patents and alleged patent rights relating to minor improvements in a long practiced art; to estop all parties to the plan, both primary and secondary, from in any manner contesting the validity of said asserted patent rights; to burden the interstate and foreign trade and commerce in gasoline, kerosene and other commodities by levying thereon heavy charges in the guise of royalties; to provide for the prepetuation of the plan beyond the life of any of their existing patents by providing for the pooling of after-acquired patents.

"To restrain many of the licensees in the amount of gasoline they may produce by fixing a limitation on production or by imposing a graduated scale of royalties, which penalizes production over a certain amount and makes it unprofitable; to restrain interstate and foreign trade and commerce by prohibiting directly the movement of large supplies of gasoline and other unpatented commodities in such commerce; and to secure to the defendant, the Standard Oil Co. of Indiana, a virtual monopoly of trade and commerce in gasoline in the fifteen states defined in the agreements as 'Indiana Co. territory.'"

British Caustic Soda Dominates Chilean Markets

In a report forwarded from Concepcion by U. S. Consul Thompson, it is stated that caustic soda occupies first place among heavy chemical imports into Chile. During the five-year period 1918 to 1922, the annual importation of caustic soda into Chille averaged 1,910 metric tons, and an average of 282 tons per year entered at Talcahuano, the principal port of the Concepcion consular district. Valparaiso is the principal market for this product and receives the bulk of the imports. An average of 80 tons a year was also imported at Valdivia. Imports of caustic soda increased greatly in 1922, when they amounted to 4,650 tons, and a further advance is believed to have been recorded in 1923.

The United States, which furnished 90 per cent of the imports in 1918, dropped to second place in 1922 with 23 per cent, being surpassed by Great Britain, which furnished about 75 per cent. The total value of the 1922 receipts was given as $363,356. Caustic soda of both British and American manufacture is in the market, with the British product leading in amount of sales, especially in the drum quantities. The decreased American participation in this trade is largely attributed to the lower prices offered by British firms.

Breithut to Speak Before Trade and Business Organizations

Dr. F. E. Breithut, chemical trade commissioner of the Department of Commerce assigned to Europe, has been made available by the Chemical Section of the Bureau of Foreign and Domestic Commerce for a limited number of appearances before business and trade organizations for personal conferences and talks on the situation of the chemical industry in Europe. Requests for Dr. Breithut's appearance should be directed to the Chemical Section at Washington by any group that is desirous of having him appear before it.

The first visit on the itinerary that in being arranged for Dr. Breithut in this connection will be in Boston July 7, when the trade commissioner will be at the district office of the Bureau of Foreign and Domestic Commerce in the Custom House for a conference with various textile interests concerned in the European situation from the standpoint of consumers of dyes.

During his investigations abroad in the last year Dr. Breithut submitted various reports on certain sections of the European industry which have been made public for the benefit of those interested in the United States, but on this personal visit to various centers of dye production and consumption in the United States he will be able to present the European situation as a whole and to answer questions from those interested.

Asbestos Industry Depressed in 1923

The Department of the Interior, through the Geological Survey, reports that the total quantity of asbestos sold by producers in 1923 was 310 short tons, valued at $24,826. Although these figures are much larger than those for 1922, the industry was far from being in a normal condition in 1923; indeed it had come almost to a complete standstill. In the following table the output in 1923 is compared with that in the three preceding years. The industry was most prosperous in 1920 when the output of crude chrysotile was the largest yet made in the history of the trade.

Domestic Asbestos Sold in U. S., 1920-1924

Year	Chrysotile		Amphibole	
	Short Tons	Value	Short Tons	Value
1920	1,245	$661,907	403	$16,324
1921	438	313,268	393	23,700
1922	25	3,320	42	6,800
1923	212	20,533	98	4,293

All the chrysotile variety of asbestos sold in 1923 was mined in Arizona and California; the amphibole variety was mined in Georgia and Maryland. Arizona produced 69 per cent of the total quantity of chrysotile asbestos sold in 1923.

News in Brief

Hydrated Lime Plant Enlarged—The United States Gypsum Co., Chicago, Ill., has placed its enlarged hydrated finishing lime plant near Genoa, Ohio, in service, completing construction which has been in progress for about 6 months. The expansion has cost approximately $300,000, and makes this the largest plant of its kind in the world, with a total of forty kilns and rated output of 500 tons of hydrate per day.

Outing of Indiana Chemists—The Indiana Section of the American Chemical Society held its annual outing at the plant of Eli Lilly & Co., Greenfield, on Saturday, June 21, being the guests of the company on the occasion. Athletic sports and a trip through the plant were among the features of the day. A picnic dinner was served in the evening.

Record Receipts of China Clay at Philadelphia—The rapid expansion in different branches of the ceramic industry is shown in the increased consumption of different raw materials, and among these English china clay takes a prominent position. The port of Philadelphia, Pa., the first 6 months of the present year has recorded the arrival of 75,000 tons of such material, as compared with less than 100,000 tons at the same port during the entire year, 1923, preceding. Other ports also show a noticeable advance, and it is currently stated by shippers at Philadelphia that the final half of the present year will duplicate, if not exceed, the record up to the present time.

Stader to Head Minerals Division—With the additional appropriations that will become available July 1, it will be possible for the Department of Commerce to expand several of its activities, one of which is its work on the non-ferrous metals. While considerable work has been done on these metals, that activity has not been accentuated as much as will be the case after July 1. The section is to be reorganized as a division, and will be known as the Minerals Division, since work will be done on other minerals. The work will be under the immediate direction of James A. Stader, who has been chief of the Minerals Section of the Iron and Steel Division.

Chemical Companies Submit Accident Report—Thirteen chemical companies, members of the Chemical Section of the National Safety Council, report an average accident severity rate of 4.783 for 1923. This is the first accident report of the Chemical Section. Eleven fatalities had much to do with the high rate. Many of the larger companies, which have carried on safety work for several years, were able to hold the rate down. The average frequency rate was 21.25.

International Mathematical Congress—Seventy scientific institutions on the American continent and ninety in Europe and elsewhere have arranged to send one or more delegates to the International Mathematical Congress, which will be held at Toronto, Canada, Aug. 11 to 16, under the auspices of the Royal Canadian Institute and the University of Toronto.

Court Permits Sale of Aluminum Plant—The United States Circuit Court of Appeals has refused the application of the Federal Trade Commission for an injunction to restrain the Aluminum Company of America from acquiring at a sheriff's sale the property of the Aluminum Rolling Mills Co.

Large Export Trade in Rubber Goods—The value of rubber goods exported in May, 1924, has been exceeded in only two months, March and April, 1923, since the close of the boom period in 1920, according to the Rubber Division of the Department of Commerce. Features of the May export trade were heavier shipments of automobile casings and other tires, rubber belting and record-breaking shipments of rubber soles and heels, which, combined with the continued activity in other lines, resulted in total shipments of rubber products valued at $3,669,432, as compared with $3,431,676 in May, 1923. For each previous month of 1924, the total value of exports has been less than in the corresponding month of 1923, owing to the depressed conditions in the tire trade.

Borax-Refining Plant to Open—The Pacific Coast Borax Co. in a few days will open its new borax-refining plant on Mormom Island, near Los Angeles, Calif. The plant cost $2,000,000 and is so located that it offers unusual facilities for distribution both to domestic and foreign markets.

French Government Acquires Potash Mines—Reports from abroad last week confirmed that the French Government has acquired the Alsatian potash mines which formerly belonged to Germany and have been sequestrated since the end of the war. The Chamber of Deputies of France will be asked to ratify the purchase during its next session, the sum involved being 200,000,000 francs, payable in 20 years. It was stated that the profits for this year are expected to reach 100,000,000 francs.

Cement Composition as Flooring for Railway Cars—Iron and wood floors in railway cars in Germany may be replaced by cement if experiments recently conducted there prove successful, according to a report from Consul-General E. T. F. Dumont, Frankfort. A composition designated as "Eisenbeton," or "iron wood," had been used in the construction of the floors of railway freight cars with a great measure of success. The first car made of "Eisenbeton" was built in 1919 by a railway car manufacturer and a portland cement concern in Heidelberg and tested in the railroad freight yards. The car, it is reported, withstood concussion at a speed of 27 kilometers and shifting tests were so satisfactory that after 5 years of service this test car still remains in perfect condition.

U. S. Quicksilver Production Increased 25 Per Cent in 1923

The condition of the quicksilver mining industry in 1923 was somewhat better than in 1922, according to a statement issued by the Geological Survey. There was an increase of nearly 14 per cent in the average price at San Francisco and an increase of nearly 25 per cent in the production. The price of the metal declined from $70.70 in the first week of 1923 to $59.35 in the last week, and the average for the year was $65.68. California produced 69 per cent of the 7,937 flasks of quicksilver credited to the United States in 1923, and most of the remainder was produced in Texas. The increase in the output of the country over that in 1922 was the result of the resumption of production at the New Idria in California. Without this contribution the production in 1923 would have been lower than in 1922. During 1923 the United States exported 318 flasks of quicksilver and imported 18,073 flasks.

Early in 1924 the price improved notably. If, as seems quite possible, the price can be maintained near or over $70 a flask, there will probably be a further increase in production in 1924, but it is doubtful whether the percentage of increase in 1924 will be as great as in 1923 unless there is an unexpectedly great increase in the price of quicksilver.

If the new mercury boiler designed by W. L. R. Emmet should prove as successful in practice as its sponsors believe, it will cause an increased demand for quicksilver, but this demand is not likely to be great in the immediate future. Should it eventually become so, a large part of the quicksilver to satisfy it will have to be sought in foreign countries, for the deposits in the United States do not appear to be adequate to supply it.

Quicksilver Produced in the United States in 1923

State	Mines Producing	Ore Treated (Short Tons)	Quicksilver Obtained Flasks of 75 Lb.	Value
California...	9	38,648	5,447	$357,759
Texas, Nevada, Oregon and Idaho..	5	12,148	2,490	163,553
Total for 1923	14	50,796	7,937	521,302
Total for 1922	10	43,084	6,375	368,348

Downward Revisions in Freight Rates on Naval Stores

A revision downward of rates on naval stores from Southern points of origin to destinations as far north as Milwaukee was ordered last Tuesday by the Interstate Commerce Commission in an investigation and suspension case involving all the rates on naval stores from Southern producing points to various destinations. The order issued last week constitutes a supplemental revision. After the original order was issued the railroads discovered inconsistencies in the rates prescribed by the commission. The railroads asked the commission for permission allowing them to bring the rates up to the level of the inconsistent figures prescribed in the original report.

Trade Notes

Oscar S. Flash, secretary of the Edward Flash Co., is seriously ill at his home in New York City. Mr. Flash has been identified with the vegetable oil trade for many years.

The sales office of the Butterworth-Judson Corporation has been moved from 30 Church St., New York, to the plant office of the company in Newark, N. J.

The Anaconda Lead Products Co., which is a Delaware corporation, has increased its capital stock from $1,000,000 to $1,500,000.

The Standard Sanitary Manufacturing Co., Pittsburgh, Pa., manufacturer of enameled iron sanitary ware, is arranging to begin production in the first unit of its new plant at Baltimore, Md., early in July. The company has a tract of 50 acres of land on Fifth Ave., and is proceeding with the erection of a number of other plant buildings, to be placed in service as soon as completed. The entire plant will represent an investment of close to $4,000,000.

The governors of the New York Produce Exchange have acted favorably on a petition to close the exchange on July 5.

Eugene Suter, head of the chemical company which bears his name, has just reached Europe on a trip in the interests of his business.

Paint, Oil and Varnish Club Holds Annual Outing

More than 100 members and guests attended the annual outing of the Paint, Oil and Varnish Club of New York, held Tuesday, June 24, at the Crescent Athletic Club, Bay Ridge, Brooklyn, N. Y. The party left New York at 10:30 a.m. on the steamer "Guy G. Major" of the American Linseed Company. After a short sail an "athlete's" lunch was served at the club. The entire afternoon was given over to games. A dinner and the distribution of prizes completed the program.

First prize for greatest number of hits in the baseball game went to McDonald, while the greatest number of runs prize was presented to Hurley. For outstanding performance at baseball the prize went to Hoefle. A. J. Wittenberg came in first in the potato race, with H. F. Kleinfeldt second. Harold Rowe and H. G. Sidford finished first in quoits. Tennis—singles—W. C. Crawford first place and H. K. McCahill second. Tennis—doubles—won by C. H. Black and H. F. Colcord. Golf—low gross—won by Peterkin. Golf—blind handicap—W. J. Harding first and J. F. Jack second. Putting contest won by F. A. Hall, with H. M. Howard second. Caterpiller race—five men to a team—won by Shaeffer, Wittenberg, Von der Lehr, Purdy and Kline. Stout gent's race won by Figgis. Sack race was captured by Sidebottom. Crab race won by Poppin. Frank Cheesman arrived first in the non-athletic event.

Exports of Chemical Products Increased in May

There was a slight decrease in free list chemicals imported in May, as compared with April, 1924. The May total of imports of that character was $6,279,677, as compared with $6,357,284 in April. There also was a decrease in dutiable chemicals, which were valued at $2,970,761 in April, compared with $2,626,150 in May.

There was a decrease in the quantity of colors, dyes, stains, color acids and color bases imported in May of this year, which amounted to 186,126 lb., compared with 206,986 lb. in April.

Fertilizer imports in May showed a slight decline. In this month 96,247 tons was imported, compared with 111,815 tons in April.

Comparative figures covering certain other chemicals are as follows:

	May 1923	May 1924
White arsenic, lb.	2,118,338	2,386,871
Citric acid, lb.	168,220	47,500
Formic acid, lb.	33,150	118,828
Tartaric acid, lb.	250,891	198,742
Copper sulphate, lb.	.....	97,742
Potassium carbonate, lb.	1,158,973	617,501
Potassium hydroxide, lb.	1,489,354	792,639
Potassium chlorate, lb.	.....	855,028
Sodium cyanide, lb.	5,643,883	3,283,945
Sodium ferrocyanide, lb.	100,263	189,411
Sodium nitrite, lb.	851,258	623,640
Sodium nitrate, tons	107,329	73,541
Dead or creosote oil, gal.	6,223,821	7,328,553
Naphthalene, lb.	2,826,925	285,906

May exports of chemicals and allied products showed an increase over April. The value of May exports was $5,116,875, compared with $4,180,169 in April, 1924. This is partly due to the decided increase of coal-tar products in May, which were valued at $1,177,428 in that month, as compared with $475,747 in April. Borax also showed an increase in May. Exports in that month were valued at $195,920, compared with $139,230 in April.

Comparative figures covering certain other exports are as follows:

	May 1923	May 1924
Benzol, lb.	15,824,024	23,538,244
Sulphuric acid, lb.	916,330	1,884,807
Acetate of lime, lb.	2,941,470	3,248,745
Bleaching powder, lb.	2,959,905	1,751,228
Potash chlorate, lb.	16,399	14,224
Potash bichromate, lb.	198,883	91,167
Sodium cyanide, lb.	751,567	176,464
Soda ash, lb.	2,498,887	1,811,960
Soda, caustic, lb.	11,269,945	6,237,549

Passing of Cut Glass Industry in New England

With the announcement that the plant of the Union Glass Co., Somerville, Mass., has been closed permanently and the property placed on the market comes the passing of the cut glass industry in New England, a branch of activity that thrived there as far back as 60 years ago, with Boston as the center of production. Practically all of the plants specialized in cut glass. There is still a plant of this character at New Bedford, but it operates differently, making the glass blank and cutting it. The Union Glass Co., just closed, has been operating since 1860 and has been losing money for a number of years past, according to a statement of its president. The contributing factors in the change of conditions are said to be the keen foreign trade competition and the labor situation, with the high wage schedules.

Financial

The board of directors of the Atlas Powder Co. held a meeting on June 24 and declared a regular dividend of 1½ per cent on the preferred stock.

The Allied Chemical & Dye Corporation has declared regular quarterly dividend of $1 on common shares.

The Canadian Industrial Alcohol Co. of Montreal has declared quarterly dividend of 2½ per cent.

Reports have been current to the affect that the Atlantic Refining Co. is about to undertake new financing to the extent of $15,000,000.

The Joseph Dixon Crucible Co. has declared a quarterly dividend of 2 per cent payable June 30.

Latest Quotations on Industrial Stocks

	Month Ago	This Week
Air Reduction	74⅞	79
Allied Chem. & Dye	71⅝	72½
Allied Chem. & Dye pfd.	115	115
Am. Ag. Chem.	*8	7⅞
Am. Ag. Chem. pfd.	24½	24
American Cyanamid	*102	*101
Am. Drug Synd.	4½	4¼
Am. Linseed Co.	16½	16
Am. Linseed pfd.	*33	*34
Am. Smelting & Refining Co.	61⅞	64
Am. Smelting & Refining pfd.	100	100½
Archer-Daniels Mid. Co. w.i.	20	21
Archer-Daniels Mid. Co. pfd.	83½	84½
Atlas Powder	*50	*49
Casein Co. of Am.	*66	*66½
Certain-Teed Products	*28	26
Commercial Solvents "A"	50⅞	54½
Corn Products (new)	35⅞	34½
Corn Products pfd.	119½	120
Davison Chem.	46½	48
Dow Chem. Co.	*45	*50
Du Pont de Nemours	115½	119½
Du Pont de Nemours db.	87	88½
Freeport-Texas Sulphur	8½	8⅞
Gold Dust	35⅞	35⅞
Grasselli Chem.	*125	*125
Grasselli Chem. pfd.	*102	*102
Hercules Powder	*95	*90
Hercules Powder pfd.	*102	*103
Heyden Chem.	1	*1
Int'l Ag. Chem. Co. (new)	3½	*4½
Int'l Ag. Chem. pfd.	5	3½
Int'l Nickel	11½	14⅞
Int'l Nickel pfd.	78	83
Int'l Salt	*77	*75
Mathieson Alkali	30	43½
Merck & Co.	64	64
National Lead	130	143½
National Lead pfd.	113	113¾
New Jersey Zinc	*140	*142
Parke, Davis & Co.	80	*80
Pennsylvania Salt	84	82
Procter & Gamble	*127	*129
Sherwin-Williams	29½	30½
Sherwin-Williams pfd.	100¾	*101¼
Tenn. Copper & Chem.	7	6¾
Texas Gulf Sulphur	60½	64½
Union Carbide	56⅞	57½
United Drug	71½	77
United Dyewood	*38⅝	39½
U. S. Industrial Alcohol	63	70
U. S. Industrial Alcohol pfd.	*100	*103
Va.-Car. Chem. Co.	1½	1½
Va.-Car. Chem. pfd.	5⅝	3½

*Nominal. Other quotations based on last sale.

Newsprint Mill Now Operating at Kenora, Canada

The new newsprint mill erected by the Backus-Brooks Co., at Kenora, Ont., is now operating and turning out approximately 75 tons per day. D. McLeod, general manager of the company, says that additional power development at the Norman Dam is contemplated and will probably be started this season.

Men You Should Know About

Dr. L. H. BAEKELAND has just been highly honored by King Albert of Belgium, who made him Commander of the Order of Leopold. Dr. Baekeland has already received such distinctions as Officer of the Legion of Honor of France and Officer of the Crown of Belgium.

EDWARD BECK, secretary of the Canadian Pulp & Paper Association, is sailing shortly for England, where he will attend the British Empire Exhibition in the interests of his association, and will take an active part in connection with the association's exhibit in the Canadian building.

CLIFFORD CARLSON is now chief chemist at the plant of the Art Metal Construction Co., Jamestown, N. Y. He has been connected with the chemical department of the company for some time and in his new position he supervises the chemical work of the company's four plants in that city.

Mr. and Mrs. J. V. N. DORR sailed on June 21 on the "Homeric" for London and will spend the summer in Europe.

WILLIAM A. DURGIN, chief of the Simplified Practice Division of the Department of Commerce, Washington, D. C., has resigned, effective July 1.

H. S. FARAM, formerly chief chemist of the Mariner and Hoskins Laboraties of Chicago, Ill., is now chief chemist and technical director of the Watervliet Paper Co., at Watervliet, Mich.

WILFORD L. FORSYTHE, secretary of the Victoria Paper Mills, Inc., Fulton, N. Y., for the past 9 years, has been elected president of the company to succeed Edwin R. Redhead, deceased. He has been connected with the company since 1898.

H. C. FULLER, of the Institute of Industrial Research, Washington, D. C., is now in Europe to attend the Fourth Congress of Industrial Chemistry at Bordeaux, France, as a delegate from the American Chemical Society. As a representative of the National Research Council, he will also attend the meeting of the International Union of Pure and Applied Chemistry, which convenes at Copenhagen, June 26 to July 1.

LINCOLN HUTCHINSON, of the California & Hawaiian Sugar Refining Corporation, San Francisco, Calif., gave an illustrated lecture recently before the members of the Pacific Traffic Association of that city, in the Merchants Exchange Building, speaking on the history of the process of sugar refining from raw material to finished product, with later references to his company's refinery at Crockett, Calif.

Dr. GRINNELL JONES has joined the party of experts who will go abroad at an early date for the United States Tariff Commission in connection with the vegetable oil investigation. He was formerly chief of the Chemical Division of the Tariff Commission.

FRANK M. JONES is now with E. I. du Pont de Nemours & Co. in their heavy chemicals and pigments plant at Philadelphia. He was formerly connected with Toch Bros. and prior to that with the Brown Co., at Berlin, N. H.

CHARLES A. KANTER, president of the Howell Foundry Co., Detroit, Mich., has been elected a member of the board of directors of the Continental Bank of Detroit.

PAUL G. LEONI, president of the Iron & Ore Corporation of America, New York, has sailed for Europe to be absent until the end of August.

Prof. RALPH H. MCKEE, of Columbia University, had conferred upon him the degree of Doctor of Laws by Carthage College, Carthage, Ill., after he made a commencement address on June 9 on "The Sciences as the Modern Humanities." Professor McKee's first teaching position was at Carthage College.

WALTER A. MARVIN, dean of Rutgers College, New Brunswick, N. J., will become acting president of the institution on July 1, to continue in this capacity until the board of trustees elects a successor to Dr. William H. S. Demarest, president of the college for a number of years, who resigns July 1.

Prof. W. A. NOYES, who lectured in England at the universities of Oxford, London, Cambridge and Manchester and in Germany, will continue his lecture tour through Switzerland and Denmark. He expects to leave for the United States from France about the middle of August.

H. C. PARMELEE, editor of *Chem. & Met.*, left New York on June 19 for a Western trip. He will address members of the American Chemical Society and the American Electrochemical Society in Los Angeles and San Francisco and will also attend the meeting of the American Institute of Chemical Engineers in Denver, returning to New York about Aug. 1.

ARTHUR SCHRODER, who has been doing research and consulting work, is now connected with the Scientific Materials Co., Pittsburgh, Pa., in charge of the technical service department.

NORMAN WATKINS, general manager of the Pacific Guano Fertilizer Co., Honolulu, Hawaii, is on a 3 months visit to the United States, and is now stopping at San Francisco, Calif., to look over the Pacific Coast interests of his company.

CLAYTON S. WOLF has resigned as chief chemist of the American Briquet Co. of Lykens, Pa., to accept a position as an assistant in the chemical engineering department of Yale University, and to do graduate work.

In recognition of contributions to science, engineering and large administrative affairs, five officials of the General Electric Co. were awarded high honorary degrees by colleges throughout the country during the month of June. CHARLES A. COFFIN, founder of the company, was honored by Princeton University with the degree of Doctor of Laws. OWEN D. YOUNG, chairman of the board of directors and a member of the recent Dawes reparation commission, received the Doctor of Laws degree from Harvard, Tufts and Dartmouth. GERARD SWOPE, president of the company, received the degree of Doctor of Science from Union College. W. L. R. EMMET, in recognition of his research and success in the mercury vapor turbine and boiler, received a Doctor of Science degree from Trinity College. EDWARD R. BERRY, who with Professor Thomson and others is largely responsible for the development of clear fused quartz, was honored by Maine University with the degree of Doctor of Science. Prof. ELIHU THOMSON, one of the founders of the company and director of the Thomson Laboratory of the G-E Co. at Lynn, Mass., will, on July 14, be given the degree of Doctor of Science at the University of Manchester, England.

Calendar

AMERICAN CERAMIC SOCIETY, summer meeting and tour, July 21 to Aug. 18.

AMERICAN ELECTROCHEMICAL SOCIETY, Detroit, Oct. 2 to 4.

AMERICAN ENGINEERING STANDARDS COMMITTEE, executive meeting, New York, July 12.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, Denver, Colo., July 15 to 18.

AMERICAN SOCIETY FOR STEEL TREATING, Boston, Sept. 22 to 26.

INSECTICIDE AND DISINFECTANT MANUFACTURERS ASSOCIATION, Montreal, Canada, June 30 to July 1.

NATIONAL SAFETY COUNCIL, thirteenth annual congress, Louisville, Ky., Sept. 29 to Oct. 3.

WORLD POWER CONFERENCE, London, June 30 to July 12.

Obituary

GAVIN COOPER, one of the founders of the Imperial Varnish & Color Co., Ltd., Toronto, died at his home in Toronto recently in his eighty-sixth year. Mr. Cooper mixed the first pot of varnish made by the Imperial Varnish & Color Co. many years ago.

ALEXANDER KELLEY, of Wilmington, Del., chemist and inventor, died at the Homeopathic Hospital in that city, June 18, as a result of burns and injuries received in an explosion on the morning of the same day. He was engaged in mixing a batch of match composition at the local plant of the K. M. C. Match Machine Manufacturing Co. when the accident occurred; the solution was one of potash content, designed for automatic machine match manufacture. At one time Mr. Kelley was connected with the Diamond Match Co. He was 68 years of age.

MICHAEL F. MCDERMOTT, of Brooklyn, N. Y., a retired leather manufacturer, died at his home in that city, June 19, aged 75 years.

Market Conditions

Trading in Arsenic Enlivens Market for Chemicals

Buying Orders Bring Out Lower Prices as Sellers Compete for Business—General Buying Remains Light

ARSENIC was about the only item of the chemical list which received much attention during the week. Buying orders were not numerous but some fairly large sized amounts are reported to have changed hands and different operators showed a desire to participate in whatever business was passing. The lowest prices heard were in evidence in the early part of the week and the absorption of low priced lots left the market in a firmer position. Whether or not there is to be a heavy late season call for calcium arsenate is still a problem and upon this will depend largely the price movement for arsenic.

Generally speaking demand for chemicals and allied products was reported as slow with an exception found in the case of a few specialties which are receiving the benefit of seasonal calls from consuming industries. Contract withdrawals of important chemicals have not gained in volume but are regarded as satisfactory in view of general industrial activities.

The weighted index number registered a gain for the period with crude cottonseed oil as a prime factor in bringing about the advance. Price changes in the chemical list are narrow with limitations on buying, serving to keep sellers on the aggressive with a consequent tendency to shade quotations on actual business.

The final hearing before the Tariff Commission on the investigation into producing costs for casein revealed that some changes had been made in the figures as previously submitted but nothing of importance appears to have arisen as a result of the more thorough investigation. Interested parties are granted further time to submit briefs and a decision by the commission does not seem immediate. It is also reported that the investigation into linseed oil has been completed but there is no intimation of the result.

Interest in dye circles has been centered on the effect of possible combinations of German and American interests. The announcement that one large domestic company would act as sales representative of a prominent German producer has revived talk of German interests entering the manufacturing field in this country although nothing definite has come to light on which to base such a probability.

Acids

Arrivals of citric and tartaric acids have been large and a good part of these receipts are reported to have passed direct to consumers. Call for spot goods also has been more prominent and prices reflect this improved condition especially in the maintenance of premiums for smaller lots. Sales of tartaric are reported at 27½c. per lb. with 27c. per lb. as an inside figure. Citric acid also has been moving freely and both importers and domestic producers have given favorable reports on current business. U. S. grade of phosphoric acid was marked up 1c. per lb. during the week but the technical grades are offered freely at former price levels. Production of acids as a whole continues along restricted lines with producers carrying surplus stocks which are none too firmly held because of the limited outlet. Fair demand is heard for boric acid but there has been no let up in competitive selling and buyers are receiving the benefit. Hydrofluoric acid has been selling on a lower basis influenced partly by the falling off in business and partly by the reduction in producing costs. The mineral acid group shows no change and surplus stocks prevent any stability to values.

Arsenic Sells at Lower Prices —Caustic Potash Easier—Bichromate of Soda at Concessions—Formaldehyde Marked Down in Price—Prussiate of Soda Dull and Easy—Salt Cake in Large Supply—Revised Price Schedule for Alcohol—Lithopone Lower

Potashes

Bichromate of Potash—Attempts to stiffen prices apparently have not entirely succeeded as there are reports to the effect that 9¼c. per lb. has been openly quoted by some producers. The firmer tone to the market is said to be due to lack of supplies in hands of certain sellers. Offerings are free, however, in other quarters and buying interest is quiet enough to bring out competition when actual business is in sight. The range of quotations is from 9¼c. to 9⅜c. per lb.

Caustic Potash—Selling pressure has been more evident and imported grades were openly quoted at 6¼c. per lb. Sales of moderate quantities were made at that price but there was no sustained buying. Forward positions were generally quoted above the spot level and the fact that replacement values were above the selling price for spot goods indicated that the latter were being sacrificed.

Permanganate of Potash—The asking price for imported permanganate in the spot market ranges from 14c. to 14¼c. per lb. but there was hardly business enough to test these prices. Some factors report the market firm at the inside figure while others say a firm bid under 14c. per lb. would uncover sellers. Shipments from foreign markets are neglected but are commanding higher prices than spot goods.

Prussiate of Potash—Domestic makes of yellow prussiate of potash are said to be moving in a moderate way but the imported material is very dull. Stocks of the latter are not heavy and the lack of buying interest has failed to bring out any weakness in price. The quotation for spot is held at 18½@19c. per lb. On later deliveries 18c. per lb. can be done but consumers are not showing any inclination to anticipate wants. Red prussiate also is reported to be dull but is quoted at 37½@40c. per lb.

Sodas

Acetate of Soda—While reports that the market is easy are common, the position of some first hands would not bear this out and the prices quoted vary according to seller. Production has been curtailed for some time and in some cases limited stocks have caused delays in shipments against standing orders. On the other hand there are producers who are said to be seeking orders at 4¼c. per lb., carlots, at works. The range in prices is from 4¼c. to 5c. per lb.

Bichromate of Soda — Resale lots were on the market and first hands less firm in their views with the result that asking prices were easy. There was no difficulty in securing stocks at 7¼c. per lb. and in some cases it was possible to do 7¼c. per lb. There have been reports that one producer was out of stocks but if so this has had no influence on the general market as offerings are more than ample to take care of present buying.

Caustic Soda—With the exception of occasional reports of price cutting, the market for domestic deliveries is on a steady basis. It is stated that prices have been shaded recently for delivery at New England points but the local market is said to be well maintained. As far as first hands are concerned the quoted price is unchanged and this holds true for prompt shipments as well as for contracts. The contract price for solid caustic is 3.10c. per lb., carlots, at works. The export price is also held at 3@3.05c. per lb., f.a.s., but in quoting for delivery to some foreign markets where competition is keen

the open quotation puts American sellers out of line and it frequently happens that concessions are granted although makers of standard brands will not admit that they are parties to such business.

Nitrate of Soda—Considerable comment has been aroused by the fact that the sale of nitrate lands which will be held at Sanitago, Chile, on Sept. 15, has been advertised in this country although the recent decree of the Chilean government prohibits American firms from purchasing further nitrate lands unless they enter the association of producers. The spot situation in nitrate is still strong because of limited stocks and $2.60 per 100 lb. and upward is asked. For July-August shipments $2.37½ per 100 lb. is quoted.

Prussiate of Soda—The protracted period of slow buying has had a depressing effect on market values and imported material was offered last week in the spot market at 9½c. per lb. There is a tendency to hold the quotation at 9¾c. per lb., but the lower figure could be done without difficulty.

Sulphate of Soda—Demand is reported to have fallen off as a result of inactivity on the part of large consuming industries. With large stocks held by sellers there has been pressure to reduce holdings. Prices for prompt and nearby deliveries are unsettled but the trend has been downward and $16 @$18 per ton is fairly representative of asking prices. Contracts covering deliveries over a protracted period are commanding a premium over the nearby positions.

Miscellaneous Chemicals

Arsenic—There were sales of domestic arsenic as high as 8¼c. per lb. in carlots, prompt shipment. Sales for distant positions were made at 7½c. per lb. and some good sized amounts are said to have sold at that level. Interest in foreign arsenic was more active and offerings at 7c. per lb. in the early part of the week found buyers. Sales also were reported at 7½c. per lb. and toward the close 7¾c. per lb. was asked by most holders. Sellers of calcium arsenate were interested in an announcement that a large mineral oil company was ready to market a liquid spray for the extermination of the boll weevil. The announcement stated that the spray would be sold in the cotton growing states, from the tank stations of the company. It was further stated that the cost would work out from $1 to $3 per acre treated, dependent on the weevil infestation and the number of sprayings.

Barium Products—The market was a little easier on imported selections. Carbonate was offered at $60@61 per ton and the chloride at $79@80 per ton. Domestic makers of both these products are still sold ahead and are not competing for spot business.

Carbon Tetrachloride — The inside price is still quoted at 7c. per lb. but the figure is more general than formerly. Competition is in evidence and small lots are said to be available at the 7c. level.

Fusel Oil—Refined grades are in moderate demand but the presence on the market of substitutes has a restricting influence on the volume of trading. Prices range from $3 to $4 per gal. according to quantity and purity. Crude is dull with sales reported under $2 per gal. but the latter is given as the general quotation.

Formaldehyde — This material has been characterized by a difference in price according to seller. In some directions 9c. per lb. is quoted for carlot shipments whereas 9½c. per lb. is an inside figure with other sellers. Small lots have sold at 9½c. per lb. and the slow buying movement has added to the irregularity of values.

"Chem. & Met." Weighted Index of Chemical Prices

Base = 100 for 1913-14

This week	155.09
Last week	154.34
June, 1923	177.00
June, 1922	157.00
June, 1921	147.00
June, 1920	274.00
June, 1919	229.00
June, 1918	272.00

Lower prices obtained for arsenic, alcohol, formaldehyde and salt cake, but, as a factor in the index number, the advance in crude cottonseed oil was responsible for the gain of 75 points.

Alcohol

There was a general reduction in both spot and contract prices for denatured alcohol. The decline in immediate shipment denatured amounted to 2c. per gal., while on August forward the drop was 1c. per gal. Formula No. 1, special, 190 proof, was offered at 43½c. per gal., in drums, and 41½c. per gal. for tank cars. Formula No. 5, 188 proof, closed at 42½c., in drums, and 40½c. in tank cars, July delivery; August-December delivery 41@41½c., in tank cars. The reduction was made to stimulate business.

Methanol, while easy in tone, underwent no change. First hands continue to quote on the basis of 80c. per gal. for the pure, tank cars, prompt shipment. Butyl alcohol was unsettled at 25@30c. per lb.

Coal-Tar Products

Selling Pressure Weakens Refined Naphthalene—Phenol Offerings Increase—Benzene, Solvent Naphtha and Toluene Steady

IMPORTANT price changes in coal-tar products were lacking. Trading was inactive, with crudes generally firm on restricted production. A feature in the situation was the continued weakness in refined naphthalene, selling pressure being apparent in several quarters, and prices were considered little more than nominal. An easier feeling prevailed for U.S.P. phenol for immediate and nearby delivery. There were sellers of pyridine at slight concessions. Offerings of cresylic acid were plentiful, but at unchanged prices. The call for aniline oil was slow. Producers of benzene report that they have been able to move all of the material produced and the market remains in a rather firm position.

Aniline Oil and Salt — Occasional sales of aniline oil went through on the old basis of 16c. per lb., drums extra, carload lots, f.o.b. works. Aniline oil for red was nominally unchanged at 40c. per lb. Aniline salt was available at 22@23c. per lb., according to quantity and seller. Export demand was dull.

Benzaldehyde—There was some competition for business and the market on the technical grade was unsettled. Nominally prices closed at 68@72c. per lb., in drums. On the U.S.P. grade $1.50 represented the market, with the free from chlorine quoted at $1.60 per lb.

Benzene—There was a firm market for all grades of benzene, but no change occurred in the selling basis. Demand was large enough to absorb offerings and any increase in the buying movement would lead to a very tight situation, according to producers. Production continues light and will remain so until improvement in the iron and steel industries calls for a larger output of coke. Nominally the market settled at 23c. per gal. on the 90 per cent grade, and at 25c. per gal. on the pure, tank cars, f.o.b. point of production.

Cresylic Acid—Competition for business was keen and prices were unsettled and subject to negotiation on contract deliveries. Open quotations ranged from 58@62c. on the dark grades, and from 63@70c. on the light 97 per cent material. Several parcels of cresylic acid and coal-tar distillate arrived here last week.

Naphthalene—There was little or no improvement in the situation, selling pressure resulting in price concessions. Closing prices were little more than nominal, especially on white flake. Refined flake was offered freely at 5c. per lb., carload lots, with reports that business went through at 4¼@4¾c. per lb. on distressed parcels. Chips held at 4¼@4½c. per lb. Crude was nominal at 2@2¼c. per lb., c.i.f. New York.

Phenol—Small lots of U.S.P. material sold on spot at 27@27½c. per lb., indicating that the market was easier. Producers were willing to take on business in nearby positions at 26c. per lb., with a possibility of doing slightly better on remainder of year contracts.

Pyridine — Offerings of imported pyridine came out at $4 per gal. The market was barely steady in the absence of any important buying and freer offerings from abroad.

Solvent Naphtha—Stocks were light and this accounts for the firm position of most sellers. Water white naphtha held at 25c. per gal., tank cars, f.o.b. works.

Toluene — Scattered business went through on the unchanged basis of 26c. per gal., tanks, f.o.b. works. The market was firm on light holdings, production being limited in all directions because of the slump in coking operations.

Vegetable Oils and Fats

Steady Call for Cottonseed and Coconut Oils Results in Higher Market—Tallow Advances—Menhaden Oil Easy

HIGHER prices prevailed for most of edible vegetable oils and quite a few of the technical oils. There was an active call for crude and refined cottonseed oil, inspired largely by the tight statistical situation in old crop holdings. Demand for Ceylon type coconut oil was good, and closing prices were ¼c. higher. Crushers reported a moderate buying movement in linseed oil, but with stocks light prices covering July-August deliveries remained firm. There was a higher market for crude corn oil, soya bean oil, refined rapeseed oil, palm oil and tallow. Menhaden oil was inactive and rather easy.

Cottonseed Oil—Prices again moved upward. Crude oil sold at 9@9¼c. per lb., tank cars, f.o.b. mills, the top figure obtaining toward the close. The demand for refined oil was good and just before the expiration of the June option in the New York market a sale went through at 11¼c. per lb. Later prices for prime summer yellow eased off a little on prospects for deliveries of more than 3,000 bbl. of July oil. In view of the bullish statistics refiners supported the market throughout the week. The fact that the cotton crop has not been doing so well has strengthened the views of longs and it is believed that some operators are accumulating a line of September and October oil. Private estimates on the cotton crop now range from 11,250,000 to 11,750,000 bales. On Thursday July prime summer yellow oil closed at 10.80@10.83c. per lb. Bleachable oil was in scanty supply and nominal at 10c. per lb., tank cars, prompt shipment from Texas common points. Lard compound was firm at 12¼@12¾c. per lb. It was reported that one producer took on a large order for compound for delivery to the Navy Department. Pure lard in Chicago, cash, closed at 10.92c. per lb.

Linseed Oil—Demand was moderate at all times, but with few crushers in a position to force business prices held on a firm basis. In fact carload business was booked at 94c. per gal., cooperage included, July-August delivery. September forward was nominal at 90@92c. per gal., but no buying interest in distant futures was apparent. There was some buying of foreign oil by American crushers for prompt shipment from the other side, sales including one lot of 800 tons in bulk. Most of the foreign crushers had little to offer for early shipment. Late in the week English oil was available at 83c. per gal., duty paid, bulk basis, September shipment from Hull. The feature in the flaxseed situation was the continued strength of the Buenos Aires market, the July option advancing to $1.79¼ on active buying for American crushers. Several crushers are reported short of seed for summer consumption. Duluth quoted July seed at $2.42 per bu., with offerings scanty. The new crop is in good condition and reports received here during the week indicate that the gain in acreage planted is considerably. The first official estimate of the new crop will be issued on July 9.

China Wood Oil—Actual holdings of China wood oil on the Pacific coast are moderate, but in the absence of important buying the market was irregular. Tank car offerings came out at 11¼c. per lb., July-August shipment from the coast. Prompt shipment oil in cooperage held at 12c. per lb., f.o.b. San Francisco. In New York spot oil closed nominally at 12¼c. per lb., cooperage basis.

Corn Oil — There was trading in crude corn oil at 9c. per lb., tank cars, f.o.b. Chicago. Some holders asked 9¼c. at the close, the strength reflecting higher prices for crude cottonseed oil.

Argentine Flaxseed Exports

While exports of flaxseed from the Argentine have been large the market has strengthened in the past month an active buying for North American crushers. The fact that the latest estimate on the 1923-24 yield places the total crop at 59,500,000 bu. tends to confirm private reports to the effect that shipments for the crop year may not exceed 51,000,000 bu.

Argentine exports, by countries, from Jan. 1 to June 20, with a comparison, follow:

	1924	1923
	Bushels	Bushels
United Kingdom	4,188,000	2,196,000
Continent	14,622,000	9,760,000
United States	12,410,000	16,916,000
On orders	6,246,000	4,900,000
Total	37,466,000	33,772,000

Coconut Oil—Inquiry was good and business was reported in Ceylon type oil at higher prices. Early in the week several tank cars sold at 7¼c. per lb., f.o.b. Pacific coast points, while later one lot of 30 tanks sold at 8c. per lb., coast basis. Offerings of Manila oil in bulk were few, with buying interest in evidence, both on the coast and here. In New York the market for Ceylon type oil settled at 8¼c. per lb., sellers' tanks, prompt and nearby delivery. Copra was offered at 5c. per lb., c.i.f. Pacific ports.

Olive Oil Foots—Prime green Italian foots held at 9¼@9¾c. per lb., the range in prices depending upon delivery and seller.

Palm Oils—Cables reported higher prices abroad and this steadied the market here. The advance in tallow also was a factor. Lagos oil was raised to 7.42c. per lb. by some importers, but others intimated that 7¼c. might still go through. Niger oil sold early in the week at 6¾c., but later 7c. represented the market with the undertone quite firm. No important buying took place.

Rapeseed Oil—English markets were higher and steadied prices here. Spot oil, refined, sold at 78½@82c. per gal., the inside figure obtaining on round lots. Futures settled around 78@78½c per gal., regular import terms.

Sesame Oil — On shipments from abroad the market advanced to 11¼c. per lb. for the refined grade, cooperage basis.

Soya Bean Oil—Crude oil was advanced to 10c. per lb., tank cars, duty paid, July shipment from the Pacific coast.

Menhaden Oil—Fishing in the past week was good and it was reported that the yield was approximately 5 gal. per 1,000 fish. Stocks of oil are not burdensome, but with buyers' ideas well below the market the undertone in most directions was easy. There were offerings at 40c. per gal., tank cars, f.o.b. point of production.

Tallow, Etc.—Sales of extra special tallow are reported at 7¼c. per lb., f.o.b. plant, an advance of ¼c. for the week. Inquiry from soap makers was good. Yellow grease firm at 6½@6¾c. per lb. Choice white sold recently at 8¾c., but holders now ask 9c. per lb. Oleo stearine sold at 11¼c. per lb. No. 1 oleo oil sold at 12¾c. per lb.

Miscellaneous Materials

Antimony—Importations have been fairly large and with no improvement in demand the market did not respond to higher prices in the Far East. Chinese and Japanese brands closed unchanged at 8¾@8¼c. per lb. Cookson's "C" grade steady at 12¼c. per lb. Chinese needle, lump, nominal at 8½@9c. per lb.

Casein — Demand slow and prices barely steady on competition between domestic and foreign brands. On the technical material quotations range from 10½@12c. per lb.

Glycerine—Dynamite was in fair request and with offerings scanty prices ruled firm at 16@16¼c. per lb., drums included, f.o.b. point of production. Chemically pure steady at 16½@17c. per lb., drums included, carload lots. Soaplye crude, basis 80 per cent, steady at 10¾@10½c. per lb., loose, carload lots, f.o.b. Middle West.

Lithopone — Leading producers announced a reduction in the price amounting to ½c. per lb. Competition has increased of late, reflecting in part the usual slump in business at this time of the year. Foreign material has been coming in more freely. Basic materials have changed but little. First hands now quote 6@6¼c. per lb., the inside figure obtaining for carload lots, in bags, delivery within 2 weeks. Spot material closed at 6¼c. per lb.

Naval Stores — The feature in the market was the decline in spirits of turpentine, the closing price being 82c. per gal., in bbl. Low grade rosins held at $5.50@$5.60 per bbl.

White Lead—The market underwent no further change, corroders asking 9½c. per lb. on standard dry, in bbl. or casks, carload basis. Pig lead was slightly easier, but the official price held at 7c. per lb.

Zinc Oxide—There was no change in the market for zinc products. Makers quote American process oxide, lead free, on the carload basis of 7¼c. per lb., in casks.

Imports at the Port of New York

June 20 to June 26

ACIDS—Citric—100 bbl., Messina, Order; 100 csk., Palermo, Order; 200 csk., Genoa, Superfos Co. **Cresylic**—14 dr., Antwerp, Lunham & Reeve. **Formic**—84 bbl., Rotterdam, A. Klipstein & Co. **Oxalic**—28 csk., Rotterdam, R. W. Greeff & Co.; 18 csk., Rotterdam, Innis, Speiden & Co. **Tartaric** — 75 csk., Rotterdam, Chemical National Bank; 150 bbl. and 200 kegs, Rotterdam, W. Benkert & Co.; 500 bbl., Patras, Superfos Co.; 20 kegs, Rotterdam, Order.

ACETONE OIL—24 dr., Trieste, Order.

ALCOHOL—110 dr. denatured, San Juan, C. Esteva; 1 cs. methyl, Helsingfors, S. H. Bergstrom.

ALUMINUM SULPHATE—90 bg., Rotterdam, R. W. Greeff & Co.

AMMONIUM NITRATE—108 csk., Hamburg, Order.

ANTIMONY REGULUS — 1,150 cs., Shanghai, Wah Chang Trading Co.

ANTIMONY SULPHIDE—8 csk., London, Order.

ARSENIC—600 cs., Kobe (at San Francisco), Horaisan Maru, Order.

ASBESTOS — 4,837 bg., Capetown, Asbestos, Ltd.; 1,429 bg., Capetown, American Magnesia & Covering Co.; 336 bg., Capetown, Standard Bank of South Africa.

BARIUM CHLORIDE—61 csk., Rotterdam, E. Suter & Co.

BARIUM NITRATE—64 csk., Rotterdam, A. Klipstein & Co.

BARIUM SULPHATE—600 bg., Seville, Order.

BARIUM PEROXIDE—352 dr., London, Order.

CALCIUM CHLORIDE—156 dr., Hamburg, C. Hardy, Inc.

CAMPHOR — 100 cs. crude, Shanghai, Eastman Kodak Co.

CASEIN—1,658 bg., Buenos Aires, Kalbfleisch Corp.

CHALK—500 bg., Antwerp, L. A. Salomon & Bros.; 200 bg., Antwerp, L. H. Butcher, Inc.; 1,250 bg., Antwerp, Brown Bros. & Co.; 350 bg., Antwerp, Order; 350 bg., Antwerp, Bankers Trust Co.; 529 tons (in bulk), Hull, Taintor Trading Co.; 592 bg., Bristol, H. J. Baker & Bro.

CHEMICALS—25 bbl., Bremen, Order; 76 csk., Rotterdam, H. Kastor; 44 bbl., Hamburg, L. Sonneborn & Sons; 121 cs., Trieste, Happel & McAvoy; 30 csk., Rotterdam, Roessler & Hasslacher Chemical Co.

CHINA CLAY—304 tons, Bristol, Moore & Munger; 60 tons, Bristol, Papermakers Import Co.; 114 bg., Bristol, Order.

CHROME ORE—3,000 tons, Beira, E. J. Lavino & Co.

COAL-TAR DISTILLATE—73 dr., Liverpool, Monsanto Chemical Works; 60 dr., Glasgow, Order.

COLORS—3 csk. aniline, Rotterdam, Order; 10 csk. do., Genoa, B. Bernard, Inc.; 30 cs. bronze, Bremen, Baer Bros.; 15 cs. do, Bremen, Bank of the Manhattan Co.; 30 csk. aniline, Bombay, Order; 5 cs. aniline, Antwerp, Geigy Co.; 2 csk. do., Hamburg, H. A. Metz & Co.; 3 pkg. do., Hamburg, Kuttroff, Pickhardt & Co.; 47 csk., Havre, Ciba Co.; 6 pkg., Havre, Sandoz Chemical Works; 2 csk., Havre, W. F. Sykes & Co.; 4 pkg., Rotterdam, H. A. Metz & Co.; 20 pkg., Rotterdam, Kuttroff, Pickhardt & Co.; 156 csk., earth, Rotterdam, C. J. Osborn & Co.

CORUNDUM ORE — 3,177 bg. Delagoa Bay, Standard Bank of South Africa.

CREOSOTE—4,967 tons (in bulk), Hull, Order.

DIVI DIVI—372 bg., Curacao, Suzarte & Whitney.

FLUORSPAR—1 lot in bulk, Rotterdam, H. Hollesen, Inc.

GLYCERINE — 10 dr., Antwerp, Brown Bros. & Co.; 55 dr. crude, Marseilles, Order.

GUMS — 420 bg. copal, Antwerp, W. Schall & Co.; 41 bg. copal, Antwerp, Chemical National Bank; 1,060 bg. karaya, Bombay, Order; 150 bg. tragacanth, Bombay, Order; 161 bg. copal, Antwerp, Order; 115 bg. copal, Manila, Chartered Bank of India, Australia & China; 192 bg. damar and 33 cs. do., Singapore, Brown Bros. & Co.; 70 bg. do., Singapore, Order; 1,167 bg. copal, Matadi, Gillespie & Co.; 243 bg. copal, Antwerp, Chemical National Bank.

IRON OXIDE — 30 csk., Hull, J. Lee Smith & Co.; 46 bbl., Malaga, L. H. Butcher Co.; 46 bbl., Malaga, J. Lee Smith & Co.; 100 bbl., Malaga, Reichard-Coulston, Inc.; 23 csk., Liverpool, Reichard-Coulston, Inc.; 17 csk., Bristol, Reichard-Coulston, Inc.; 50 bbl. and 166 bg., Bristol, G. Z. Graves & Co.; 29 csk., Bristol, Order.

LITHOPONE — 80 csk., Rotterdam, Reichard-Coulston, Inc.; 16 csk., Rotterdam, Acme White Lead & Color Works; 40 csk., Rotterdam, L. H. Butcher & Co.; 1,450 csk., Antwerp, B. Moore & Co.

MANGANESE ORE — 1,000 tons, Bombay, Order.

MAGNESITE — 287 bbl., Rotterdam, Brown Bros. & Co.; 250 bg., Antwerp, Order; 217 bbl., Rotterdam, Brown Bros. & Co.; 1,456 bg., Glasgow, Brown Bros. & Co.

MYROBALANS — 13,883 bg., Bombay, Order; 600 pkt., Calcutta, Order; 1,970 bg., Bombay, National City Bank.

NAPHTHALENE — 500 bg., Rotterdam, Lunham & Reeve.

OILS—Coconut—500 tons, Cebu, (arrived at San Francisco), Order. **Olive Foots** (sulphur oil)—250 bbl., Patras, T. Torelli & Co.; 100 bbl., Messina, Chemical National Bank; 150 csk., Genoa, Leghorn Trading Co. **Palm Kernel**—160 bbl., Hull, Order; 202 bbl., Liverpool, E. F. Jones & Co. **Palm**—876 dr., Matadi, Niger Co.; 349 csk., Warri, African & Eastern Trading Co.; 79 csk., Lagos, Niger Co.; 163 csk., Hamburg, African & Eastern Trading Co.; 1,149 csk., Accra, Niger Co.; 314 csk., Accra, African & Eastern Trading Co. **Rapeseed**—50 bbl., Hull, Balfour, Williamson & Co.; 100 bbl., Hull, Bank of the Americas; 140 bbl., Hull, J. C. Francesconi & Co.; 435 bbl., Hull, Order; 269 csk., Havre, Vacuum Oil Co.

OIL SEEDS—Copra—18,873 bg., Manila, etc. (at San Francisco), Order; 69 bg., Morant Bay, Franklin Baker Co.; 138 bg., Bowden, Order. **Castor**—38,776 bg., Bombay, Order; 4,098 bg., Coconada, Order; 2,800 bg., Bombay, Order; 2,800 bg., Bombay, E. D. Sasson & Co.; 1,426 bg., Bombay, Volkart Bros. **Linseed**—93,315 bg., Buenos Aires, Order; 33,530 bg., Buenos Aires, L. Dreyfus & Co.; 8,872 bg., Buenos Aires, Bingham & Co.; 8,919 bg., Buenos Aires, Order; 106,318 bg., Rosario, Spencer Kellogg & Sons.

PHOSPHORUS—200 cs. amorphous, Antwerp, W. E. Miller; 8 cs. do., London, Order.

POTASSIUM SALTS—200 csk. alum, Rotterdam, A. Klipstein & Co.; 255 csk. alum, Rotterdam, Superfos Co.; 24 csk. bicarbonate, Rotterdam, E. Suter & Co.; 167 dr. caustic, Hamburg, Goldschmidt Corp.; 82 bbl. hydrate, Hamburg, Innis, Speiden & Co.; 5534 bg. muriate, Antwerp, Society Comm. des Potasses d'Alsace; 30 csk. alum, Rotterdam, Jungmann & Co.; 18 kegs prussiate, Liverpool, C. Tennant Sons & Co.; 100 csk. chlorate, Hamburg, Seaboard National Bank; 40 kegs bicarbonate, Bristol, R. W. Greeff & Co.; 300 bbl. chlorate, Antwerp, Byrnes Co.; 12 cs. cyanide, Antwerp, C. Hardy, Inc.; 500 bg. nitrate, Antwerp, Order.

PYRIDINE—6 dr., Rotterdam, American Bluefriesveem, Inc.; 4 dr., Rotterdam, Lunham & Reeve.

QUICKSILVER—50 flasks, London, A. Pickering Co.

QUEBRACHO — 22,754 bg. extract, Buenos Aires, International Products Co.; 25 bg., Buenos Aires, R. J. Gates.

SAL AMMONIAC—125 csk., Bristol, C. de P. Field Co.

SHELLAC—210 bg., Karachi, Order; 300 bg., Calcutta, Brunswick-Balke-Collender Co.; 504 cs., Singapore, Order; 25 bg., London, Marx & Rawolle; 500 bg., London, Order; 12 cs., Rotterdam, C. F. Gerlach.

SODIUM SALTS—156 cs. cyanide, Liverpool, American Cyanamid Co.; 24 csk. prussiate, Liverpool, C. Tennant Sons & Co.; 100 dr. sulphite, Bristol, R. F. Downing & Co.; 100 csk. sulphate, Antwerp, E. Suter & Co.

STRONTIUM NITRATE—93 csk., Rotterdam, Lunham & Moore.

SUMAC—210 bg., Palermo, Order; 350 bg. ground, Palermo, R. Neumann & Co.; 280 bg. do., Palermo, Order.

TALC—400 bg., Genoa, L. A. Salmon & Bro.; 400 bg., Genoa, Bankers Trust Co.; 200 bg., Genoa, C. H. Chrystal & Co.; 250 bg., Genoa, L. A. Salmon & Bro.

TARTAR—533 bg., Tarragona, Harshaw, Fuller & Goodwin; 224 bg., Valencia, Harshaw, Fuller & Goodwin; 150 bg., Valencia, Royal Baking Powder Co.; 250 bg., Genoa.

TURMERIC—294 bg., Bombay, Order; 146 bg., Coconada, Order.

WATTLE BARK — 2,329 bg., Natal, Order.

WAXES—203 bg. carnauba, Cara, National City Bank; 264 bg. do., Cara, Lazard Freres; 69 bg. do., Cara, Duncan Hood & Co.; 224 bg. do., Cara, Order; 100 cs. vegetable, Kobe, National City Bank; 79 bg. carnauba, Bahia, Order; 11 bg. do., Bahia, J. H. Rossbach; 159 bg. carnauba, Hamburg, Coal & Iron National Bank; 32 bg. beeswax, Rotterdam, Ponds Extract Co.; 122 bbl. spermacetti, Glasgow, Order; 106 bg. beeswax and 168 bg. carnauba, Rio de Janeiro, American Trading Co.

WOOL GREASE — 30 bbl., Bremen, Order; 50 bbl., Bremen, Pfaltz & Bauer; 12 bbl., Hamburg, Commercial Sales & Supply Co.; 90 bbl., Antwerp, Order.

ZINC SULPHATE — 4 dr., Rotterdam, A. Kretschmar.

ZINC WHITE—55 cs., Rotterdam, Roessler & Hasslacher Chemical Co.

ZINC OXIDE—120 bbl., Antwerp, Philipp Bros.

Opportunities in the Foreign Trade

Parties interested in any of the following opportunities may obtain all available information from the Bureau of Foreign and Domestic Commerce at Washington or from any district office of the bureau. The number placed after the opportunity must be given for the purpose of identification.

ACETATE OF LIME and acetic acid. Milan, Italy. Agency.—10,656.

CHEMICALS. Cologne, Germany. Purchase and agency.—10,650.

CHEMICALS, brewers', and heavy chemicals. Lille, France. Agency.—10,645.

CHEMICALS, Heavy. Florence, Italy. Agency.—10,653.

CHEMICALS, photographic. Giza, Egypt. Purchase.—10,711.

COLORS and coloring supplies, best quality. Florence, Italy. Purchase and agency.—10,652.

COLORS and paints, metal (dry). Amsterdam, Netherlands. Exclusive agency.—10,651.

DYES. Bahia, Brazil. Agency.—10,647.

DYESTUFFS. Batavia, Java. Purchase and agency.—10,688.

NAVAL STORES. Melbourne, Australia. Exclusive agency.—10,646.

OIL, Linseed. Batavia, Java. Purchase and agency.—10,688.

PAINTS and varnishes. Durban, South Africa. Agency.—10,693.

SODA, Caustic. Bahia, Brazil. Agency.—10,647.

SODA, Caustic. San Jose, Costa Rica. Purchase.—10,648.

SODA, Caustic. Hamburg, Germany. Purchase and agency.—10,649.

SODA, Caustic. Batavia, Java. Purchase and agency.—10,688.

SODA, Phosphate and nitrate of. Kingston, Jamaica. Purchase.—10,654.

TAR in shipments of 20 to 50 tons. Hamburg, Germany. Purchase.—10,649.

OILS AND GREASES. Cairo, Egypt. Purchase and agency.—10,632.

Current Prices in the New York Market

For Chemicals, Oils and Allied Products

THESE prices are for the spot market in New York City, but a special effort has been made to report American manufacturers' quotations whenever available. In many cases these are for material f.o.b. works or on a contract basis and these prices are so designated. Quotations on imported stocks are reported when they are of sufficient importance to have a material effect on the market. Prices quoted in these columns apply to large quantities in original packages.

General Chemicals

Acetone, drums, wks.	lb.	$0.15 – $0.15½
Acetic anhydride, 85%, dr.	lb.	.38 – ....
Acid, acetic, 28%, bbl.	100 lb.	3.12 – 3.37
Acetic, 56%, bbl.	100 lb.	5.85 – 6.10
Acetic, 80%, bbl.	100 lb.	8.19 – 8.44
Glacial, 99½%, bbl.	100 lb.	11.01 – 11.51
Boric, bbl.	lb.	.09 – .09½
Citric, kegs	lb.	.47 – .48
Formic, 85%	lb.	.12½ – .13
Gallic, tech.	lb.	.45 – .50
Hydrofluoric, 52%, carboys	lb.	.11 – .12
Lactic, 44%, tech., light, bbl.	lb.	.12½ – .13
22% tech., light, bbl.	lb.	.06 – .06½
Muriatic, 18° tanks	100 lb.	.80 – .85
Muriatic, 20°, tanks	100 lb.	.95 – 1.00
Nitric, 36°, carboys	lb.	.04 – .04½
Nitric, 42°, carboys	lb.	.04½ – .05½
Oleum, 20%, tanks	ton	16.00 – 17.00
Oxalic, crystals, bbl.	lb.	.09½ – .10
Phosphoric, 50% carboys	lb.	.07 – .08
Pyrogallic, resublimed	lb.	1.55 – 1.60
Sulphuric, 60°, tanks	ton	9.00 – 10.00
Sulphuric, 60°, drums	ton	13.00 – 14.00
Sulphuric, 66°, tanks	ton	14.00 – 15.00
Sulphuric, 66° drums	ton	18.00 – 19.00
Tannic, U.S.P., bbl.	lb.	.65 – .70
Tannic, tech., bbl.	lb.	.45 – .50
Tartaric, imp., powd., bbl.	lb.	.27 – .28
Tartaric, domestic, bbl.	lb.	.30 – ....
Tungstic, per lb.	lb.	1.20 – 1.25
Alcohol, butyl, drums, f.o.b. works	lb.	.25 – .30
Alcohol ethyl (Cologne spirit), bbl.	gal.	4.83 – ....
Ethyl, 190 p'f. U.S.P., bbl.	gal.	4.81 – ....
Alcohol, methyl (see Methanol)		
Alcohol, denatured, 190 proof		
No. 1, special bbl.	gal.	.49½ – ...
No. 1, 190 proof, special, dr.	gal.	.43½ – ...
No. 1, 188 proof, bbl.	gal.	.50½ – ...
No. 1, 188 proof, dr.	gal.	.46½ – ...
No. 5, 188 proof, bbl.	gal.	.48½ – ...
No. 5, 188 proof, dr.	gal.	.42½ – ...
Alum, ammonia, lump, bbl.	lb.	.03½ – .04
Potash, lump, bbl.	lb.	.02½ – .03½
Chrome, lump, potash, bbl.	lb.	.05½ – .06
Aluminum sulphate, com., bags	100 lb.	1.35 – 1.40
Iron free bags	lb.	2.35 – 2.45
Aqua ammonia, 26°, drums	lb.	.06½ – .06¾
Ammonia, anhydrous, cyl.	lb.	.28 – .30
Ammonium carbonate, powd. tech., casks	lb.	.12 – .13
Ammonium nitrate, tech., casks	lb.	.09 – .10
Amyl acetate tech., drums	gal.	3.00 – ....
Antimony oxide, white, bbl.	lb.	.10 – .10½
Arsenic, white, powd., bbl.	lb.	.07½ – .08
Arsenic, red, powd., kegs	lb.	.14½ – .15½
Barium carbonate, bbl.	ton	60.00 – 62.00
Barium chloride, bbl.	ton	79.00 – 82.00
Barium dioxide, 88%, drums	lb.	.17½ – .18
Barium nitrate, casks	lb.	.08½ – .08¾
Blanc fixe, dry, bbl.	lb.	.03½ – .04
Bleaching powder, f.o.b. wks., drums	100 lb.	1.90 – ....
Spot N. Y. drums	100 lb.	2.20 – 2.25
Borax, bbl.	lb.	.05 – .05½
Bromine, cases	lb.	.28 – .30
Calcium acetate, bags	100 lb.	3.00 – 3.05
Calcium arsenate, dr.	lb.	.09½ – .10
Calcium carbide, drums	lb.	.05 – .05½
Calcium chloride, fused, dr. wks.	ton	21.00 – ....
Gran. drums works	ton	27.00 – ....
Calcium phosphate, mono, bbl.	lb.	.06½ – .07½
Camphor, Jap. cases	lb.	.72 – .73
Carbon bisulphide, drums	lb.	.06 – .06½
Carbon tetrachloride, drums	lb.	.07 – .07½
Chalk, precip.—domestic, light, bbl.	lb.	.04½ – .04½
Domestic, heavy, bbl.	lb.	.03½ – .04
Imported, light, bbl.	lb.	.04½ – .05
Chlorine, liquid, tanks, wks.	lb.	.04½ – ....
Contract, tanks, wks.	lb.	.04½ – ....
Cylinders, 100 lb., wks.	lb.	.05½ – .07½
Chloroform, tech., drums	lb.	.30 – .32
Cobalt, oxide, bbl.	lb.	2.10 – 2.25
Copperas, bulk, f.o.b. wks.	ton	16.00 – 18.00
Copper carbonate, bbl.	lb.	.15½ – .16
Copper cyanide, drums	lb.	.45 – .46
Coppersulphate, dom., bbl., Imp bbl.	100 lb.	4.40 – 4.60
Cream of tartar bbl.	100 lb.	4.25 – ....
Epsom salt, dom., tech., bbl.	lb.	.20½ – .21
Epsom salt, imp., tech., bags	100 lb.	1.75 – 2.00
Epsom salt, U.S.P., dom., bbl.	100 lb.	1.25 – 1.35
Ether, U.S.P., dr.	lb.	2.10 – 2.35
Ethyl acetate, 85%, drums	gal.	.14 – .15
		.92 – .95
Ethyl acetate, 99%, dr.	gal.	$1.08 – $1.10
Formaldehyde, 40%, bbl.	lb.	.09 – .09½
Fullers earth—f.o.b. mines	ton	7.50 – 18.00
Furfural, works, bbl.	lb.	.25 – ....
Fusel oil, ref., drums	gal.	3.00 – 3.75
Fusel oil, crude, drums	gal.	2.00 – 2.25
Glaubers salt, works, bags	100 lb.	1.20 – 1.40
Glaubers salt, imp., bags	100 lb.	.90 – .95
Glycerine, c.p., drums extra	lb.	.16½ – .16¾
Glycerine, dynamite, drums	lb.	.16 – .16½
Glycerine, crude 80%, loose	lb.	.10¼ – .10½
Hexamethylene, drums	lb.	.65 – .70
Lead:		
White, basic carbonate, dry, casks	lb.	.09½ – ....
White, basic sulphate, casks	lb.	.09½ – ....
White, in oil, kegs	lb.	.11¼ – .12½
Red, dry, casks	lb.	.10½ – ....
Red, in oil, kegs	lb.	.12½ – .13½
Lead acetate, white crys., bbl.	lb.	.14½ – ....
Brown, broken, casks	lb.	.13½ – ....
Lead arsenate, powd., bbl.	lb.	.16 – .18
Lime-Hydrated, bg, wks.	ton	10.50 – 12.50
Bbl., wks.	ton	18.00 – 19.00
Lime, Lump, bbl.	280 lb.	3.63 – 3.65
Litharge, comm., casks	lb.	.10 – .10½
Lithopone, bags	lb.	.06½ – .06¾
Magnesium carb., tech., bags	lb.	.08½ – .08¾
Methanol, 95%, bbl.	gal.	.80 – ....
Methanol, 97%, bbl.	gal.	.82 – ....
Methanol, pure, tanks	gal.	.80 – ....
drums	gal.	.82 – ....
bbl.	gal.	.87 – ....
Methyl-acetone, t'ks.	gal.	.70 – .75
Nickel salt., double, bbl.	lb.	.09 – .10½
Nickel salts, single, bbl.	lb.	.10 – .11
Orange mineral, csk	lb.	.13½ – .14½
Phosgene	....	.60 – .75
Phosphorus, red, cases	lb.	.70 – .75
Phosphorus, yellow, cases	lb.	.37½ – .40
Potassium bichromate, casks	lb.	.09½ – .09¾
Potassium bromide, gran., bbl.	lb.	.22 – .38
Potassium carbonate, 80-85%, calcined, casks	lb.	.05½ – .05¾
Potassium chlorate, powd.	lb.	.07½ – .08¼
Potassium cyanide, drums	lb.	.47 – .52
Potassium, first sorts, cask	lb.	.07½ – .08
Potassium hydroxide (caustic potash) drums	lb.	.06½ – .06¾
Potassium iodide, cases	lb.	3.65 – 3.75
Potassium nitrate, bbl.	lb.	.06 – .07½
Potassium permanganate, drums	lb.	.14 – .14½
Potassium prussiate, red, casks	lb.	.35 – .38
Potassium prussiate, yellow, casks	lb.	.18½ – .18¾
Salammoniac, white, gran., casks, imported	lb.	.06¾ – .06¾
Salammoniac, white, gran., b d., domestic	lb.	.07½ – .08
Gray, gran., casks	lb.	.08 – .09
Salsoda, bbl.	100 lb.	1.20 – 1.40
Salt cake (bulk) works	ton	16.00 – 18.00
Soda ash, light, 58% flat, bulk, contract	100 lb.	1.25 – ....
bags, contract	100 lb.	1.38 – ....
Soda ash, dense, bulk, contract, basis 58%	100 lb.	1.35 – ....
bags, contract	100 lb.	1.45 – ....
Soda, caustic, 76%, solid, drums contract	100 lb.	3.10 – ....
Soda, caustic, ground and flake, contracts, dr.	100 lb.	3.50 – 3.85
Soda, caustic, solid, 76% f. a.s. N. Y.	100 lb.	2.90 – 3.05
Sodium acetate, works, bbl.	lb.	.04½ – .05
Sodium bicarbonate, bulk	100 lb.	1.75 – ....
330-lb. bbl.	100 lb.	2.00 – ....
Sodium bichromate, casks	lb.	.07½ – .07¾
Sodium bisulphate (niter cake)	ton	6.00 – 7.00
Sodium bisulphite, powd., U.S.P., bbl.	lb	.04½ – .04¾
Sodium chlorate, kegs	lb.	.06½ – .07
Sodium chloride	long ton	12.00 – 13.00
Sodium cyanide, cases	lb.	.19 – .22
Sodium fluoride, bbl.	lb.	$0.08½ – $0.10
Sodium hyposulphite, bbl.	lb.	.02½ – .02¾
Sodium nitrite, casks	lb.	.08½ – .08¾
Sodium peroxide, powd., cases	lb.	.23 – .27
Sodium phosphate, dibasic, bbl.	lb.	.03½ – .03¾
Sodium prussiate, yel. bbl.	lb.	.09½ – .10½
Sodium salicylic, drums	lb.	.38 – .40
Sodium silicate (40°, drums)	100 lb.	.75 – 1.15
Sodium silicate (60°, drums)	100 lb.	1.75 – 2.00
Sodium sulphide, fused, 60-62% drums	lb.	.03½ – .03½
Sodium sulphite, crys., bbl.	lb.	.02½ – .03
Strontium nitrate, powd., bbl.	lb.	.10 – .10½
Sulphur chloride, yel drums	lb.	.04½ – .05
Sulphur, crude	ton	18.00 – 20.00
At mine, bulk	ton	16.00 – 18.00
Sulphur, flour, bag	100 lb.	2.25 – 2.35
Sulphur, roll, bag	100 lb.	2.00 – 2.10
Sulphur dioxide, liquid, cyl.	lb.	.08 – .08
Tin bichloride, bbl.	lb.	.12 – ....
Tin oxide, bbl.	lb.	.48 – ....
Tin crystals, bbl.	lb.	.31½ – ....
Zinc carbonate, bags	lb.	.12 – .14
Zinc chloride, gran, bbl.	lb.	.05½ – .07½
Zinc cyanide, drums	lb.	.36½ – .37
Zinc dust, bbl	lb.	.08 – .08½
Zinc oxide, lead free, bag	lb.	.07½ – ....
5% lead sulphate bags	lb.	.07½ – ....
10 to 35 % lead sulphate, bags	lb.	.07 – ....
French, red seal, bags	lb.	.09½ – ....
French, green seal, bags	lb.	.10½ – ....
French, white seal, bbl.	lb.	.12 – ....
Zinc sulphate, bbl.	100 lb.	3.00 – 3.25

Coal-Tar Products

Alpha-naphthol, crude, bbl.	lb.	$0.60 – $0.65
Alpha-naphthol, ref., bbl.	lb.	.65 – .75
Alpha-naphthylamine, bbl.	lb.	.35 – .36
Aniline oil, drums	lb.	.16 – .16½
Aniline salt, bbl.	lb.	.22 – .23
Anthracene, 80%, drums	lb.	.70 – .75
Anthraquinone, 25%, paste, drums	lb.	.75 – .80
Benzaldehyde U.S.P., carboys	lb.	1.50 – ....
f.f.c. drums	lb.	1.60 – ....
tech., drums	lb.	68 – .72
Benzene, pure, water-white, tanks, works	gal.	.25 – ....
Benzene, 90%, tanks, works	gal.	.23 – ....
Benzidine base, bbl.	lb.	.80 – .82
Benzidine sulphate, bbl.	lb.	.70 – .72
Benzoic acid, U.S.P., kegs	lb.	.75 – 85
Benzoate of soda, U.S.P., bbl.	lb.	.65 – 70
Benzyl chloride, 95-97%, ref. carboys	lb.	.35 – ....
Benzyl chloride, tech., drums	lb.	.25 – ....
Beta-naphthol, tech., bbl.	lb.	.24 – .25
Beta-naphthylamine, tech.	lb.	.65 – .70
Cresol, U.S.P., drums	lb.	.22 – .26
Ortho-cresol, drums	lb.	.28 – .32
Cresylic acid, 97%, works drums	gal.	.63 – .67
95-97%, drums, works	gal.	.58 – .61
Dichlorbenzene, drums	lb.	.07 – .08
Diethylaniline, drums	lb.	.53 – .58
Dimethylaniline, drums	lb.	.36 – .38
Dinitrobenzene, bbl.	lb.	.15 – .17
Dinitrochlorbenzene, bbl.	lb.	.21 – .22
Dinitronaphthalen, bbl.	lb.	.30 – .32
Dinitrophenol, bbl.	lb.	.35 – .40
Dinitrotoluen, bbl.	lb.	.18 – .20
Dip oil, 25%, drums	gal.	.26 – .28
Diphenylamine, bbl.	lb.	.48 – .50
H-acid, bbl.	lb.	.72 – .75
Meta-phenylenediamine, bbl.	lb.	.95 – 1.00
Michlers ketone, bbl.	lb.	3.00 – 3.25
Monochlorbenzene, drums	lb.	.08 – .10
Monoethylaniline, drums	lb.	1.20 – 1.30
Naphthalene, flake, bbl.	lb.	.05 – .05½
Naphthalene, balls, bbl.	lb.	.06 – .06½
Naphthionate of soda, bbl.	lb.	.60 – .65
Naphthionic acid, crude, bbl.	lb.	.60 – .62
Nitrobenzene, drums	lb.	.09 – .09½
Nitro-naphthalene, bbl.	lb.	.25 – .30
Nitro-toluene, drums	lb.	.13½ – .14
N-W acid, bbl.	lb.	1.00 – 1.05
Ortho-amidophenol, kegs	lb.	2.40 – 2.50
Ortho-dichlorbenzene, drums	lb.	.12 – .13
Ortho-nitrophenol, bbl.	lb.	1.25 – 1.30
Ortho-nitrotoluene, drums	lb.	.11 – .12
Ortho-toluidine, bbl.	lb.	.13 – .14
Para-aminophenol, base, kegs	lb.	1.15 – 1.20
Para-aminophenol, HCl, kegs	lb.	1.30 – 1.40
Para-dichlorbenzene, bbl.	lb.	.17 – .20
Paranitraniline, bbl.	lb.	.68 – .70
Para-nitrotoluene, bbl.	lb.	.58 – .60
Para-phenylenediamine, bbl.	lb.	1.35 – 1.45
Para-toluidine, bbl	lb.	.72 – .80
Phthalic anhydride, bbl.	lb.	.30 – .34
Phenol, U.S.P., dr.	lb.	.26 – .27½
Picric acid, bbl.	lb.	.20 – 22
Pitch, tanks, works	ton	25.00 – 30.00
Pyridine, imp., drums	gal.	4.00 – 4.50
Resorcinol, tech., kegs	lb.	1.30 – 1.40

Resorcinol, pure, kegs	lb.	$2.00 –	$2.25
R-salt, bbl	lb.	.50 –	.55
Salicylic acid, tech., bbl	lb.	.32 –	.33
Salicylic acid, U.SP., bbl	lb.	.35 –	..
Solvent naphtha, water-white, tanks	gal.	.25 –	....
Crude, tanks	gal.	.22 –	....
Sulphanilic acid, crude, bbl	lb.	.16 –	.18
Toluidine, bbl	lb.	1.00 –	1.05
Toluidine, mixed, kegs	lb.	.30 –	.35
Toluene, tank cars, works	gal.	.26 –	....
Toluene, drums, works	gal.	.30 –	....
Xylidine, drums	lb.	.48 –	.50
Xylene, 3 deg.-tanks	gal.	.40 –	....
Xylene, com., tanks	gal.	.28 –	....

Naval Stores

Rosin B-D, bbl.	280 lb.	$5.50 –	$5.55
Rosin E-I, bbl.	280 lb.	5.65 –	5.70
Rosin K-N, bbl.	280 lb.	5.90 –	6.10
Rosin W.G.-W.W., bbl.	280 lb.	7.00 –	7.60
Wood rosin, bbl.	280 lb.	5.40 –	5.50
Turpentine, spirits of, bbl.	gal.	.82 –	.83
Wood, steam dist., bbl.	gal.	.75 –	.76
Wood, dest. dist., bbl.	gal.	.58 –	.60
Pine tar pitch, bbl.	200 lb.	5.50 –	.....
Tar, kiln burned, bbl.	500 lb.	10.50 –	.....
Retort tar, bbl.	500 lb.	10.50 –	.....
Rosin oil, first run, bbl.	gal.	.38 –	.....
Rosin oil, second run, bbl.	gal.	.43 –	.....
Rosin oil, third run, bbl.	gal.	.48 –	.....
Pine oil, steam dist.	gal.	.60 –	.....
Pine tar oil, com'l	gal.	.30 –	.....

Animal Oils and Fats

Degras, bbl.	lb.	$0.03½–	$0.05½
Grease, yellow, loose	lb.	.06½–	.06¾
Lard oil, Extra No. 1, bbl.	gal.	.85 –	.....
Lard compound, bbl.	lb.	.12½–	.12¾
Neatsfoot oil 20 deg. bbl.	gal.	1.26 –	.....
No. 1, bbl.	gal.	.86 –	.88
Oleo Stearine	lb.	.11½–	.....
Oleo oil, No. 1, bbl.	lb.	.12 –	.....
Red oil distilled, d.p. bbl.	lb.	.08½–	.09
Saponified, bbl.	lb.	.08½–	.09
Tallow, extra, loose works	lb.	.07 –	.....
Tallow oil, acidless, bbl.	gal.	.82 –	.....

Vegetable Oils

Castor oil, No. 3, bbl.	lb.	$0.15½–	.....
Castor oil, No. 1, bbl.	lb.	.16 –	.....
Chinawood oil, bbl.	lb.	.12½–	.12¾
Coconut oil, Ceylon, bbl.	lb.	.09½–	.09¾
Ceylon, tanks, N.Y.	lb.	.08½–	.....
Coconut oil, Cochin, bbl.	lb.	.10 –	.10¾
Corn oil, crude, bbl.	lb.	.11½–	.11¾
Crude, tanks, (f.o.b. mill)	lb.	.09 –	.....
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.09½–	.09¾
Summer yellow, bbl.	lb.	.11½–	.11¾
Winter yellow, bbl.	lb.	.12 –	.12¾
Linseed oil, raw, car lots, bbl.	gal.	.94 –	.....
Raw, tank cars (dom.)	gal.	.88 –	.....
Boiled, cars, bbl. (dom.)	gal.	.96 –	.....
Olive oil, denatured, bbl.	gal.	1.20 –	1.25
Sulphur, (foots) bbl.	lb.	.09 –	.09½
Palm, Lagos, casks	lb.	.07½–	.....
Niger, casks	lb.	.07 –	.....
Palm kernel, bbl.	lb.	.09 –	.09½
Peanut oil, crude, tanks (mill)	lb.	.11½–	.....
Peanut oil, refined, bbl.	lb.	.14½–	.15
Perilla, bbl.	lb.	.14 –	.14½
Rapeseed oil, refined, bbl.	gal.	.79 –	.....
Sesame, bbl.	lb.	.11 –	.11½
Soya bean (Manchurian), bbl.	lb.	.11½–	.11½
Tank, f.o.b. Pacific coast	lb.	.10 –	.....
Tank, (f.o.b. N.Y.)	lb.	.10½–	.....

Fish Oils

Cod, Newfoundland, bbl.	gal.	$0.60 –	$0.62
Menhaden, light pressed, bbl.	gal.	.56 –	.....
White bleached, bbl.	gal.	.58 –	.....
Blown, bbl.	gal.	.62 –	.....
Crude, tanks (f.o.b. factory)	gal.	.40 –	.....
Whale No. 1 crude, tanks, coast	lb.	.....	.....
Winter, natural, bbl.	gal.	.75 –	.76
Winter, bleached, bbl.	gal.	.78 –	.79

Oil Cake and Meal

Coconut cake, bags	ton	$28.00 –	29.00
Cottonseed meal, f.o.b. mills	ton	36.00 –	37.00
Linseed cake, bags	ton	34.00 –	34.50
Linseed meal, bags, spot	ton	39.00 –	41.00

Dye & Tanning Materials

Albumen, blood, bbl.	lb.	$0.50 –	$0.55
Albumen, egg, tech, kegs	lb.	.95 –	.97
Cochineal, bags	lb.	.33 –	.35
Cutch, Borneo, bales	lb.	.04½–	.04¾
Cutch, Rangoon, bales	lb.	.13½–	.14¼
Dextrine, corn, bags	100 lb.	3.77 –	....
Dextrine gum, bags	100 lb.	4.02 –	....
Divi-divi, bags	ton	39.00 –	40.00
Fustic, sticks	ton	30.00 –	35.00
Fustic, chips, bags	lb.	.04 –	.05
Gambier com., bags	lb.	.12½–	.13
Logwood, sticks	ton	25.00 –	26.00
Logwood, chips, bags	lb.	.02½–	.03
Sumac, leaves, Sicily, bags	ton	165.00 –	170.00
Sumac, ground, bags	ton	155.00 –	160.00
Sumac, domestic, bags	ton	50.00 –	55.00
Starch, corn, bags	100 lb.	3.07 –	3.82
Tapioca flour, bags	lb.	.04½–	.06

Extracts

Archil, conc., bbl.	lb.	$0.16 –	$0.19
Chestnut, 25% tannin, tanks	lb.	.01½–	.02
Divi-divi, 25% tannin, bbl.	lb.	.04½–	.05½
Fustic, crystals, bbl.	lb.	.20 –	.22
Fustic, liquid, 42°, bbl.	lb.	.08 –	.09
Gambier, liq., 25% tannin, bbl.	lb.	.11 –	.11½
Hematine crys., bbl.	lb.	.14 –	.18
Hemlock, 25% tannin, bbl.	lb.	.03½–	.04
Hypernic, solid, drums	lb.	.22 –	.24
Hypernic, liquid, 51°, bbl.	lb.	.12 –	.13
Logwood, crys., bbl.	lb.	.14 –	.15
Logwood, liq., 51°, bbl.	lb.	.07½–	.08½
Osage Orange, 51°, liquid, bbl.	lb.	.07 –	.08
Osage Orange, powder, bg.	lb.	.14 –	.15
Quebracho, solid, 65% tannin, bbl.	lb.	.04½–	.04¾
Sumac, dom., 51°, bbl.	lb.	.06½–	.07

Dry Colors

Blacks–Carbongas, bags, f.o.b. works, contract	lb.	$0.09 –	$0.11
spot, cases	lb.	.12 –	.16
Lampblack, bbl.	lb.	.12 –	.40
Mineral, bulk	ton	35.00 –	45.00
Blues–Bronze, bbl.	lb.	.38 –	.40
Prussian, bbl.	lb.	.38 –	.40
Ultramarine, bbl.	lb.	.08 –	.35
Browns, Sienna, Ital., bbl.	lb.	.06 –	.14
Sienna, Domestic, bbl.	lb.	.03½–	.04
Umber, Turkey, bbl.	lb.	.04 –	.04½
Greens–Chrome, C.P.Light, bbl.	lb.	.28 –	.30
Chrome, commercial, bbl.	lb.	.11½–	.12
Paris, bulk	lb.	.24 –	.26
Reds, Carmine No. 40, tins	lb.	4.25 –	4.50
Iron oxide red, casks	lb.	.08 –	.12
Para toner, kegs	lb.	.95 –	1.00
Vermilion, English, bbl.	lb.	1.30 –	1.35
Yellow, Chrome, C.P. bbls.	lb.	.17 –	.17½
Ocher, French, casks	lb.	.02½–	.03

Waxes

Bayberry, bbl.	lb.	$0.21 –	$0.21½
Beeswax, crude, Afr. bg.	lb.	.26 –	.27
Beeswax, refined, light, bags	lb.	.32 –	.34
Beeswax, pure white, cases	lb.	.40 –	.41
Candelilla, bags	lb.	.23 –	.23½
Carnauba, No. 1, bags	lb.	.40 –	.40½
No. 2, North Country, bags	lb.	.29 –	.30
No. 3, North Country, bags	lb.	.22 –	.23
Japan, cases	lb.	.22 –	.23
Montan, crude, bags	lb.	.05½–	.06
Paraffine, crude, match, 105-110 m.p., bbl.	lb.	.05½–	....
Crude, scale 124-126 m.p. bags	lb.	.04½–	.04¾
Ref., 118-120 m.p., bags	lb.	.05 –	.05½
Ref., 123-125 m.p., bags	lb.	.05½–	....
Ref, 128-130 m.p., bags	lb.	.05½–	.05¾
Ref., 133-135 m.p., bags	lb.	.06½–	.07
Ref., 135-137 m.p., bags	lb.	.07½–	.08
Stearic acid, agle pressed, bags	lb.	.10½–	....
Double pressed, bags	lb.	.11 –	....
Triple pressed, bags	lb.	.12½–	....

Fertilizers

Acid phosphate, 16%, bulk, works	ton	$7.50 –	$7.75
Ammonium sulphate, bulk f.o.b. works	100 lb.	2.50 –	.....
Blood, dried, bulk	unit	4.10 –	4.15
Bone, raw, 3 and 50, ground	ton	26.00 –	28.00
Fish scrap, dom., dried, wks.	unit	..... –	.....
Nitrate of soda, bags	100 lb.	2.60 –	.....
Tankage, high grade, f.o.b. Chicago	unit	2.50 –	.....
Phosphate rock, f.o.b. mines Florida pebble, 68-72%	ton	3.25 –	3.70
Tennessee, 75%	ton	6.75 –	7.00
Potassium muriate, 80%, bags	ton	34.55 –	.....
Potassium sulphate, bags basis 90%	ton	45.85 –	.....
Double manure salt	ton	26.35 –	.....
Kainit	ton	7.22 –	.....

Crude Rubber

Para—Upriver fine	lb.	$0.20 –	.....
Upriver coarse	lb.	.14½–	.....
Upriver caucho ball	lb.	.14½–	.14¾
Plantation—First latex crepe	lb.	.19½–	.19¾
Ribbed smoked sheets	lb.	.18¾–	.....
Amber crepe No. 1	lb.	.19 –	.19¼

Gums

Copal, Congo, amber, bags	lb.	$0.09 –	$0.14
East Indian, bold, bags	lb.	.13 –	.14
Manila, pale, bags	lb.	.18 –	.19
Pontinak, No. 1 bags	lb.	.19 –	.20
Damar, Batavia, cases	lb.	.23 –	.23½
Singapore, No. 1, cases	lb.	.27½–	.28
Singapore, No. 2, cases	lb.	.18½–	.19
Kauri, No. 1, cases	lb	.58 –	.64
Ordinary chips, cases	lb.	.21 –	.22
Manjak, Barbados, bags	lb.	.06 –	.09

Shellac

Shellac, orange fine, bags	lb.	$0.56 –	$0.57
Orange superfine, bags	lb.	.58 –	....
A. C. garnet, bags	lb.	.52 –	....
Bleached, bonedry	lb.	.64 –	.65
Bleached, fresh	lb.	.53 –	.54
T. N., bags	lb.	.53 –	.54

Miscellaneous Materials

Asbestos, crude No. 1 f.o.b., Quebec	...sh ton	$300.00 –	$400.00
Asbestos, shingle, f.o.b., Quebec	...sh. ton	50.00 –	70.00
Asbestos, cement, f.o.b., Quebec	...sh ton	20.00 –	25.00
Barytes, grd., white, f.o.b. mills, bbl.	...net ton	16.00 –	17.00
Barytes, grd., off-color, f.o.b. Balt.	...net ton	13.00 –	14.00
Barytes, floated, f.o.b. St. Louis, bbl.	...net ton	23.00 –	24.00
Barytes, crude f.o.b. mines, bulk	...net ton	8.00 –	8.50
Casein, bbl., tech.	...lb.	.10½–	.12
China clay (kaolin) crude, No. 1, f.o.b. Ga.	...net ton	7.00 –	8.00
Washed, f.o.b. Ga.	...net ton	8.50 –	9.00
Powd., f.o.b. Ga.	...net ton	14.00 –	20.00
Crude f.o.b. Va.	...net ton	6.00 –	8.00
Ground, f.o.b. Va.	...net ton	13.00 –	19.00
Imp., lump, bulk	...net ton	15.00 –	20.00
Imp., powd.	...net ton	45.00 –	50.00
Feldspar, No. 1 f.o.b. N.C.	...long ton	7.00 –	7.50
No. 2 f.o.b. N.C.	...long ton	4.50 –	5.00
No. 1 gr'd. N. C.	...long ton	15.32 –	21.00
No. 1 Canadian, f.o.b. mill, powd.	...long ton	20.00 –	.....
Graphite, Ceylon, lump, first quality, bbl.	...lb.	.05½–	.06
Ceylon, chip, bbl.	...lb.	.04½–	.05
High grade amorphous crude	...ton	15.00 –	35.00
Gum arabic, amber, sorts, bags	...lb.	.11½–	.12
Gum tragacanth, sorts, bags	...lb.	.48 –	.50
No. 1, bags	...lb.	1.20 –	.....
Kieselguhr, f.o.b. Cal.	...ton	40.00 –	42.00
F.o.b. N. Y.	...ton	50.00 –	55.00
Magnesite, calcined, f.o.b. Cal.	ton	35.00 –	45.00
Pumice stone, imp., casks	...lb.	.03 –	.40
Dom., lump, bbl.	...lb.	.06 –	.08
Dom., ground, bbl.	...lb.	.03 –	.05
Silica, glass sand, f.o.b. Ind.	...ton	2.00 –	2.50
Silica, sand blast, f.o.b. Ind.	...ton	2.25	3.50
Silica, amorphous, 200-mesh, f.o.b. Ill.	...ton	20.00 –	.....
Silica, glass sand, f.o.b. Ill.	...ton	2.00 –	2.50
Soapstone, coarse, f.o.b. Vt., bags	...ton	7.50 –	8.00
Tale, 200 mesh, f.o.b., Vt., bags, extra	...ton	10.50 –	.....
Tale, 200 mesh, f.o.b. Ga., bags	...ton	8.00 –	10.00
Tale, 325 mesh, f.o.b. New York, grade A bags	...ton	14.75 –	.....

Mineral Oils

Crude, at Wells

Pennsylvania	bbl.	$3.25 –	$3.75
Corning	bbl.	1.90 –	.....
Cabell	bbl.	1.70 –	.....
Somerset	bbl.	1.80 –	.....
Illinois	bbl.	2.07 –	.....
Indiana	bbl.	2.08 –	.....
Kansas and Okla. under 28 deg.	bbl.	.90 –	.....
California, 35 deg. and up	bbl.	1.40 –	.....

Gasoline, Etc.

Motor gasoline, steel bbls.	gal.	$0.20 –	.....
Naphtha, V. M. & P. deod, steel bbls	gal	.19 –	.....
Kerosene, ref. tank wagon	gal.	.14 –	.....
Bulk, W.W. delivered, N.Y.	gal.	.08 –	.....
Lubricating oils:			
Cylinder, Penn., filtered	gal.	.30 –	.35
Bloomless, 30@31 grav.	gal.	.21 –	.22
Paraffin, pale 885 vis	gal.	.16 –	.17
Spindle, 200, pale	gal.	.22 –	.....
Petrolatum, amber, bbls.	lb.	.04½–	.04¾
Paraffine wax (see waxes)			

Refractories

Bauxite brick, 56% Al_2O_3, f.o.b. Pittsburgh	1,000	$140-$145
Chrome brick, f.o.b. Eastern shipping points	ton	45-47
Chrome cement, 40-50% Cr_2O_3	ton	23-27
40-45% Cr_2O_3, sacks, f.o.b. Eastern shipping points	ton	23.00
Fireclay brick, 1st. quality, 9-in. shapes, f.o.b. Ky. wks.	1,000	42-45
2nd. quality, 9-in. shapes, f.o.b. wks.	1,000	35-38
Magnesite brick, 9-in. straight (f.o.b. wks.)	ton	65-68
9-in. arches, wedges and keys	ton	80-85
Scraps and splits	ton	85
Silica brick, 9-in. sizes, f.o.b. Chicago district	1,000	48-50
Silica brick, 9-in. sizes, f.o.b. Birmingham district	1,000	48-50
F.o.b. Mt. Union, Pa.	1,000	38-40
Silicon carbide refract. brick, 9-in.	1,000	1,180.00

Ferro-Alloys

Ferrotitanium, 15-18% f.o.b. Niagara Falls, N.Y.	ton	$200.00 –	.....

Ferrochromium, per lb. of Cr, 1-2% C	lb.	$0.30 –	
4-6% C	lb.	.11½–	
Ferromanganese, 76-82% Mn, Atlantic seabd. duty paid	gr. ton	107.50 –	
Spiegeleisen, 19-21% Mn	gr. ton	36.00 –	38.00
Ferromolybdenum, 50-60% Mo, per lb. Mo	lb.	2.00 –	2.25
Ferrosilicon, 10-12%	gr. ton	41.50 –	46.50
50%	gr. ton	75.00 –	
Ferrotungsten, 70-80%, per lb. of W	lb.	.90 –	.93
Ferro-uranium, 35-50%, of U, per lb. of U	lb.	4.50 –	
Ferrovanadium, 30-40%, per lb. of V	lb.	3.50 –	4.00

Ores and Semi-finished Products

Bauxite, dom. crushed, dried, f.o.b. shipping points	ton	$5.50 –	$8.75
Chrome ore Calif. concentrates, 50% min. Cr_2O_3	ton	22.00 –	
C.i.f. Atlantic seaboard	ton	19 00 –	22.00
Coke, fdry., f.o.b. ovens	ton	4.50 –	5.00
Coke, furnace, f.o.b. ovens	ton	3.25 –	3.40
Fluorspar, gravel, f.o.b. mines, Illinois	ton	23.50 –	
Ilmenite, 52% TiO_2 Va	lb.	.01½–	
Manganese ore, 50% Mn, c.i.f. Atlantic seaport	unit	.42 –	.46
Manganese ore, chemica (MnO_2)	ton	75.00 –	80.00
Molybdenite, 85% MoS_2, per lb. MoS_2, N. Y.	lb.	.80 –	
Monazite, per unit of ThO_2, c.i.f., Atl. seaport	lb.	.06 –	.08
Pyrites, Span., fines, c.i.f. Atl. seaport	unit	.11½–	.12
Pyrites, Span., furnace size, c.i.f. Atl. seaport	unit	.11½–	.12
Pyrites, dom. fines, f.o.b. mines, Ga.	unit	.12 –	
Rutile, 94@96% TiO_2	lb.	.12 –	.15
Tungsten, scheelite, 60% WO_3 and over	unit	9.25 –	
Tungsten, wolframite, 60% WO_3	unit	9.00 –	9.25
Uranium ore (carnotite) per lb. of U_3O_8	lb.	3.50 –	3.75
Uranium oxide, 96% per lb. U_3O_8	lb.	12.25 –	2.50
Vanadium pent oxide, 99%	lb.	2.00 –	14.00
Vanadium ore, per lb. V_2O_5	lb.	1.00 –	1.25
Zircon, 99%	lb.	.06 –	.07

Non-Ferrous Metals

Copper, electrolytic	lb.	$0.12½–	$0.12½
Aluminum, 98 to 99%	lb.	.27 –	.28
Antimony, wholesale, Chinese and Japanese	lb.	.08½–	.08½
Nickel, 99%	lb.	.27 –	.30
Monel metal, shot and blocks	lb.	.32	
Tin, 5-ton lots, Straits	lb.	.43½	
Lead, New York, spot		07	
Lead, E. St. Louis, spot	lb.	.0680	
Zinc, spot, New York	lb.	.0610	
Zinc, spot, E. St. Louis	lb.	.0575	
Silver (commercial)	oz.	.66	
Cadmium	lb.	.60	
Bismuth (500 lb. lots)	lb.	2.35-2.40	
Cobalt	lb.	2.50-3.00	
Magnesium, ingots, 99%	lb.	.90-.95	
Platinum, refined	oz.	116.00	
Iridium	oz.	260.00-270.00	
Palladium	oz.	78.00-83.00	
Mercury	75 lb.	73.00-74.00	
Tungsten powder	lb.	.95-1.00	

Finished Metal Products

	Warehouse Price Cents per Lb.
Copper sheets, hot rolled	19.25
Copper bottoms	29.25
Copper rods	19.75
High brass wire	17.75
High brass rods	15.00
Low brass wire	19.50
Low brass rods	20.50
Brazed bronze tubing	24.34
Seamless copper tubing	22.75
Seamless high brass tubing	21.50

OLD METALS—The following are the dealers purchasing prices in cents per pound

Copper, heavy and crucible	10.50 @ 10.75
Copper, heavy and wire	10.00 @ 10.12½
Copper, light and bottoms	8.50 @ 8.62½
Lead, heavy	5 67½@ 5 87½
Lead, tea	3 75 @ 4 00
Brass, heavy	6.00 @ 6.25
Brass, light	4 75 @ 4.87½
No. 1 yellow brass turnings	6 50 @ 6.75
Zinc scrap	3 50 @ 3.75

Structural Material

The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses in the cities named:

	New York	Chicago
Structural shapes	$3.49	$3.49
Soft steel bars	3.49	3.49
Soft steel bar shapes	3.59	3.59
Soft steel bands	4.39	4.39
Plates, ¼ to 1 in. thick	3 59	3.59

Industrial

Financial, Construction and Manufacturing News

Construction and Operation

Alabama

ATTALLA—The A. C. Foundry Co., recently organized, plans for the erection of a 1-story foundry for the production of iron and other metal castings. J. W. Alford and J. W. Carroll, both of Attalla, head the company.

CHEROKEE—The Cherokee Rock Asphalt Co. has commenced the installation of equipment at its proposed local plant, including crushing rolls, etc., for commercial rock asphalt production. It is expected to provide facilities for an output of close to 1,000 tons daily. C. M. Colston is construction engineer in charge.

Arizona

PHOENIX—The Vapoline Power & Sales Co., 315-17 Heard Bldg., recently organized, is perfecting plans for the establishment of a local compounding plant for the production of a liquid fuel, with special vaporizing qualities. Mulford Winsor is president, and L. J. Lipsohn, secretary.

California

OAKLAND—The Clorox Chemical Co., 850 42nd Ave., has plans for the erection of a new 2-story works at 42nd Ave. and Watling St., estimated to cost $25,000. Work will be commenced at an early date.

LOS ANGELES—The Death Valley Borax Co. is perfecting plans for the erection of a new refining plant at Los Angeles Harbor, where tract of property recently was selected. It will cost in excess of $200,000, with equipment. Raw material will be secured from the company's property in the Furnace Creek district, Death Valley. The capital of the organization has been increased to finance the new plant.

EMERYVILLE—The California Pottery Co., San Francisco, has acquired property in the vicinity of its East Bay plant, at Park Ave. and Haven St., totaling about 40,000 sq.ft., and plans for the construction of a number of 1-story additions. Work will soon be started on a new distributing plant at Fresno, Calif., to cost about $18,000, for which plans have been drawn by the Ernest J. Kump Co., Rowell Bldg., Fresno.

CULVER CITY—The De-Lite Mfg. Co., recently organized with a capital of $100,000, will soon begin the erection of a new local plant, 1-story, 40x142 ft., to be equipped for the manufacture of paste, glue and other adhesive products. L. A. Bahner, Hermosa Beach, Calif., is vice-president in charge.

OAKLAND—The Schumacher Wall Board Co., American Bank Bldg., San Francisco, manufacturer of composition board products, has acquired a tract of about 5 acres of land here, near the line of the Southern Pacific R.R., and contemplates the early preparation of plans for a new plant. It will consist of a number of buildings, with cost estimated in excess of $75,000, including equipment.

Florida

VERO—The Indian River Fertilizer Co., recently organized with capital of $150,000, has awarded a general contract to L. M. Newman, Vero, for the construction of a 1-story plant, 52x130 ft., for the production of commercial fertilizer. It will be equipped for an initial output of 60 tons per day. A portion of the machinery will be furnished by the Atlantic Utility Works, East Point, Ga. Howard F. Smith is president.

ST. PETERSBURG—The Department of Public Utilities, R. E. Ludwig, director, has arranged a fund of $125,000, to be used for extensions in the municipal artificial gas plant and system. Plans will soon be perfected.

Georgia

ATLANTA—The Board of Trustees, Georgia School of Technology, has arranged an appropriation of $100,000, for the construction of a new chemistry building at the institution, for which plans will be prepared in the near future. N. E. Harris is chairman.

OAKLAND—Fire, June 14, destroyed a portion of the local 2-story plant of the Standard Gas Products Co., Atlanta, Ga., manufacturer of commercial gases, oxygen, etc., with loss estimated at $75,000, with equipment. Plans are under advisement for rebuilding.

Illinois

HINSDALE—The Village Council has plans in preparation for the installation of a water softener plant at the municipal waterworks, estimated to cost $50,000, for which bids will soon be asked. Frank B. Danielson, Hinsdale, is engineer.

CHICAGO—Fire, June 17, destroyed a portion of the 4-story plant of the G. J. Liebich Co., 164-68 West Kinzie St., manufacturer of paints and varnishes, with loss estimated at $75,000, including equipment. It is planned to rebuild.

Indiana

INDIANA HARBOR—The Youngstown Sheet & Tube Co., Youngstown, O., has enlargements under way at its local plant, formerly the works of the Steel & Tube Co. of America, recently acquired. The expansion program will involve a total of $4,500,000, for buildings and equipment, and will require a number of months for completion.

Louisiana

LOREAUVILLE—The Loreauville Sugar Co. has commenced the rebuilding of the portion of its Vida sugar mill, Iberia Parish, destroyed by fire caused by a boiler explosion, several months ago. The work will also include the remodeling of a section of the mill, and the installation of a filter press department. It is expected to have the plant ready for operation well in time for the coming season. H. N. Pharr is president, and N. J. Caillouet, chief engineer.

Maryland

BALTIMORE—The Colloidal Soap Products Co. has acquired a local building at Haines and Warner Sts., and will improve and equip for a new plant for the manufacture of a line of soap products, washing powders, etc. John R. Williams is general manager.

BALTIMORE—The Baltimore Copper Smelting & Rolling Co., Canton, a subsidiary of the American Smelting & Refining Co., 120 Broadway, New York, has plans nearing completion for the erection of a new mill for finished wire and rod production, with initial capacity of about 4,000 tons per month. It is expected to begin work at an early date. The company plans for the rebuilding of the portion of its silver refinery, destroyed by fire, June 14. An official estimate of loss has not been announced.

BALTIMORE—The Quaker Industrial Alcohol Corp., 82nd St., Philadelphia, Pa., has leased a portion of the former brewing plant on Harford Ave., near Monument St., and plans the immediate installation of equipment for a branch factory, to be used primarily for the production of denatured alcohol. A. M. Stutman is in charge.

BALTIMORE—The Oles Envelope Corp., 514 East Lombard St., has filed plans for the erection of a new 1-story plant, 100x200 ft., on Montebello Ave., near 25th St., estimated to cost $30,000. A general contract has been let to the H. K. Ferguson Co., Euclid Ave., Cleveland, O.

Michigan

MUSKEGON—Fire, June 15, destroyed a portion of the local celluloid plant of the Brunswick-Balke-Collender Co., with loss estimated at $17,000. It is purposed to rebuild. Headquarters of the company are at 629 South Wabash Ave., Chicago, Ill.

New Jersey

CARTERET—The United States Metal Refining Co. plans for the early erection of a new addition to its local plant, with reported cost placed in excess of $75,000, including equipment.

NEWARK—The International Oxygen Co., 762 Frelinghuysen Ave., has filed plans for the construction of a new 1-story building at its plant, estimated to cost $22,000.

New York

NEW YORK—The United Sanitary Products Co., 65 5th Ave., New York, manufacturer of liquid soap and kindred products, is having plans drawn by B. Dreisler, 153 Remsen St., Brooklyn, architect, for a new 4-story plant at Foster Ave. and Buckley St., 100x100 ft., estimated to cost $155,000. Bids will be called at an early date. Benjamin Newman is president.

BROOKLYN—Kienle & Co., 109 South 5th St., manufacturers of inks, etc., have plans for the erection of a 3-story addition to their plant, to be located on Nassau Ave., near Dobbins St., estimated to cost $85 000. It is expected to ask bids at an early date. William H. Gompert, 171 Madison Ave., New York, is architect.

Ohio

SANDUSKY—The Sandusky China Co. now being organized by local interests, headed by W. J. Frey, will have plans drawn at an early date for the erection of a new plant on local site for the manufacture of vitrified china and hotel ware. The pottery will consist of a main structure, 150x375 ft., with six kilns, and will cost close to $95,000. A list of equipment to be installed will soon be arranged. The new company will operate with a capital of $200,000.

ST. BERNARD — The Cincinnati Chemical Co., Cincinnati, has awarded a general contract to J. & F. Harig, Cincinnati, for the erection of a 1-story plant on Murray Rd., near Spring Grove Ave., on which work will be commenced at once.

Pennsylvania

PITTSBURGH — The Standard Sanitary Mfg. Co., Bessemer Bldg., manufacturer of enameled iron sanitary ware, is perfecting plans for the erection of a new 4-story building, 90x250 ft., on Galveston Ave., Northside, a site recently purchased from the Hall Pump Co. It will be used for general operating service and will cost close to $100,000.

READING—The Reading Glazed Paper Co., recently organized, is said to be planning to take over and operate the former local mill of the Doty & Scrimgeour Co., manufacturer of glazed paper specialties, recently acquired at a receiver's sale by Clinton E. Woods, 1421 Chestnut St., Philadelphia, Pa., at a price of $53,000. Improvements will be made in the equipment. Francis H. Bohlen, Jr., Haverford, Pa., is treasurer of the new company.

NEW CASTLE—The Blair Strip Steel Co., lately organized, is pushing construction on its new plant near the city limits, and plans to have the works ready for operation during July. The plant will represent an investment of $75,000, and will be devoted to the manufacture of cold-rolled steel products.

JOHNSTOWN—Of a fund of $30,000,000 recently arranged by bond issue, the Bethlehem Steel Co., Bethlehem, Pa., has announced intentions of using $20,000,000, for enlargements and improvements at its local Cambria Works, including new mills and equipment. The expansion program will be carried out over a period of 18 months.

South Carolina

GREENVILLE—The Sana-Chem Co., Columbia, S. C., manufacturer of disinfectants, etc., is reported to be planning for the establishment of a new plant at Greenville, and will remove its present factory to this location. The capacity will be increased.

South Dakota

RAPID CITY—The South Dakota State Cement Commission, A. C. Hunt, secretary, has work in progress on a new local mill, and plans for the installation of equipment at an early date.

Tennessee

MEMPHIS — The Ramler-Hall Waxed Paper Co. has taken over property on Linden Ave., consisting of a number of buildings, and will remodel and equip for a new plant for the manufacture of waxed and kindred papers. Work will soon begin.

JOHNSON CITY—The Golding Sons Co., East Liverpool, O., producer of clay, feldspar and kindred products for ceramic use, is said to be planning for the erection of a new feldspar grinding mill on local site, totaling about 12 acres, estimated to cost in excess of $85,000, including equipment.

Texas

HOUSTON—The Magnolia Petroleum Co., Magnolia Bldg., has tentative plans under consideration for the rebuilding of the portion of its storage and distributing plant recently destroyed by fire, with loss reported in excess of $200,000, including equipment.

Virginia

BEDFORD—The Bedford Tire & Rubber Co. has taken bids on a 2-story and basement plant for the manufacture of automobile tires and other rubber products, and plans to break ground at an early date. A. K. Simmons, Roanoke, Va., is architect. L. R. Gills is president.

WAYNESBORO—The Virginia Apple Products Co., recently organized with a capital of $2,000,000, plans the erection of a 1-story concentrating plant in connection with a local works. A list of equipment to be installed will soon be arranged. W. H. Bardner is president.

Washington

SEATTLE—The Pacific Stove & Foundry Co., 1102 Idaho St., has awarded a contract to W. J. Symonds, 4568 13th St., S. W., for the erection of a 1-story foundry addition, to be used for the production of iron castings.

West Virginia

MORGANTOWN—The Board of Trustees, West Virginia University, is arranging an additional fund of $100,000, for the completion and equipment for the new chemistry building, now in course of construction. Frank B. Trotter is president.

New Companies

FARMINGTON RIVER PAPER CO., Windsor, Conn.; paper and pulp products; $50,000. Incorporators: William R. and Robert D. Kent, Passaic, N. J.; and W. N. Pratt, Windsor.

KEMOZONE LABORATORIES, INC., 68 Evergreen St., Bayonne, N. J.; chemical products; 20,000 shares of stock, no par value. Incorporators: Albert R. Lindman and Lester C. Burdett, both of Bayonne.

CENTRAL MICHIGAN MUTUAL OIL CO., Adrian, Mich.; mineral oils; $50,000. Incorporators: A. R. Sheffield, Charles A. Shierson and Leslie B. Robertson, 1109 Lafayette Bldg., Detroit. The last noted is representative.

DENISON INTERLOCKING TILE CO., Jacksonville, Fla.; tile and other burned clay products; $50,000. Incorporators: Harvey L. Miller and C. W. Dixon, Graham Bldg., Jacksonville. The last noted will be president.

FORALIN PRODUCTS CORP., Albany, N. Y.; paints, varnishes, etc.; $100,000. Incorporators: P. Ehrlich, E. H. Pottle and A. W. Twitchell. Representative: T. F. McDermott, Albany, attorney.

SNYDER RUBBER CO., 160 North Wells St., Chicago, Ill.; rubber products; $100,000. Incorporators: George J. Haberer, Ray L. Smith and Theodore J. Snyder.

REDBIRD GUANO CO., Tallahassee, Fla.; fertilizer products; $10,000. Incorporators: De F. L. and Cornelius Christiance, both of Tallahassee.

PETROLEUM RECOVERY CO., Los Angeles, Calif.; petroleum and petroleum byproducts; $150,000. Incorporators: H. H. Cannon, M. F. Chadwick and H. C. Ellmaker. Representative: Jones, Wilson & Stephenson, 522 Citizens National Bank Bldg., Los Angeles.

BACKMAN BROTHERS INC., Philadelphia, Pa.; celluloid products; $125,000. W. J. Backman, Manheim Apartments, Philadelphia, is treasurer and representative.

PIERRE VIDVARD CIE, INC., Paterson, N. J.; paints and varnishes; 1,000 shares of stock, no par value. Incorporators: Edgar J. and Robert B. Howarth, and B. Franklin Reinauer, 402 East 37th St., Paterson. The last noted is representative.

S. & B. ART GLASS CORP., 624 Cedar St., Rockford Ill.; art glass and other glass products; 500 shares of stock, no par value. Representative: C. W. C. Summerfield, 713 Cottage Grove Ave., Rockford.

GUTHRIE COTTON OIL CO., Guthrie, Okla.; cottonseed oil products; $200,000. Incorporators: C. W. Patterson and A. T. Buenting, both of Guthrie.

LOEBOYLE REFINING CO., Tulsa, Okla.; refined petroleum products; $100,000. Incorporators: R. A. Kleinschmidt and Marvin T. Johnson, 1006 Mid-Continent Bldg., Tulsa.

O'DONNELL RUBBER PRODUCTS CO., Cincinnati, O.; rubber goods; $25,000. Incorporators: L. J. Dolle and W. C. Taylor, both of Cincinnati.

MOHAWK PAINT CO., Springfield, Mass.; paints, varnishes, etc.; $10,000. Oliver S. Thayer is president, and Edward J. Ryan, Springfield, treasurer and representative.

HASKIN PRODUCTS CO., Goshen, Ind.; washing powders, water softeners, etc.; $10,000. Incorporators: F. N. Hascall, C. A. Whittle and O. N. Kinnison, all of Goshen.

SEMINOLE PULP & PAPER CORP., Palatka, Fla.; paper and pulp products; $200,000. J. J. Fort is president, and L. M. Johnson, secretary, both of Palatka.

GENE MORRIS PACIFIC COAST CO., Los Angeles, Calif.; paints, oils, varnishes, etc.; $100,000. Incorporators: E. W. Morris and D. F. Anderson. Representative: Lon A. Brooks, 1131 Chapman Bldg., Los Angeles.

HIRSCHMAN CHEMICAL CO., INC., Brooklyn, N. Y.; chemicals and chemical byproducts; $25,000. Incorporators: S. Okin and H. Z. Hirschman. Representative: Benjamin Machinist, 277 Broadway, New York.

TAY-STONE OIL CO., Taylorville, N. C.; refined oil products; $100,000. Incorporators: Samuel T. Crowson, J. A. Miller, Jr., and H. T. Kelly, all of Taylorville.

WHITE LION RUBBER WORKS, INC., Taylor, Tex.; rubber products; $15,000. Incorporators: H. H. Theis, Y. F. Hopkins and S. G. Gernert, all of Taylor.

NASSAU LYK-GLASS CORP., Freeport, L. I.; enamel products; $50,000. Incorporators: R. J. Miller, R. T. Rasmussen and H. H. Pottle. Representative: L. Fishel, Freeport, attorney.

PACIFIC CAST IRON PIPE & FOUNDRY CO., Los Angeles, Calif.; iron and other metal castings; $300,000. Incorporators: R. P. Drummond, C. R. Gallagher and J. A. Dunn. Representative: E. C. Rivenius, Pasadena, Calif.

AZTEX REFINING CO., Tulsa, Okla.; refined petroleum products; capital stock not stated. Incorporators: Herbert Storck and John T. Lindsay, 829 Mayo Bldg., Tulsa.

MAX MERTEN CORP., New York, N. Y.; enamel ware; $10,000. Incornorators: Max Merten, H. H. and J. H. Cohen. Representative: J. A. Arnold, 22 William St., New York.

PINE-O-SALES CHEMICAL CO., Bayonne, N. J.; chemicals and chemical byproducts; 2,500 shares of stock, no par value. Incorporators: Ernest H. Mayon and Louis Bell, 49 West 22nd St., Bayonne. The last noted is representative.

DOWNEY INSULATION CO., Philadelphia, Pa., care of the Capital Trust Co. of Delaware, Dover, Del., representative; mica and mica products; $5,000. Incorporators: Gilbert H. Downey and Arthur J. Henry, Philadelphia.

Industrial Notes

THE ECONOMY FUSE & MFG. CO., Chicago, Ill., announces the appointment of Morgan P. Ellis as general sales manager. Mr. Ellis has been assistant general sales manager for the past 8 years.

J. B. PATTERSON, who for the past 8 years has been district manager for the P. H. & F. M. Roots Co., of Connersville, Ind., in charge of its Chicago office, is leaving the organization July 1. Mr. Patterson is a graduate engineer and has been in charge of the Roots advertising as well as the territory sales work. After July 1 Mr. Patterson will head his own company, called the Patterson Sales Engineering Service, the temporary address of which is 901 Hearst Bldg., Chicago. This will be an organization of experienced sales engineers and will represent a group of manufacturers of machinery and supplies. Lines handled will include centrifugal and reciprocating pumps, compressors fans and turbo blowers, steam and oil engines, couplings, belting, packing, etc.

G. G. Crewson and A. E. Smith have formed the INDUSTRIAL EQUIPMENT CO. at 184 Elk St., Buffalo, N. Y., for the purpose of sales and consulting engineering. Mr. Crewson was formerly associated with E. I. du Pont de Nemours & Co. and with the National Aniline & Chemical Co. and Mr. Smith was formerly associated with the Solvay Process Co. and the National Aniline & Chemical Co.

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CHEMICAL & METALLURGICAL ENGINEERING

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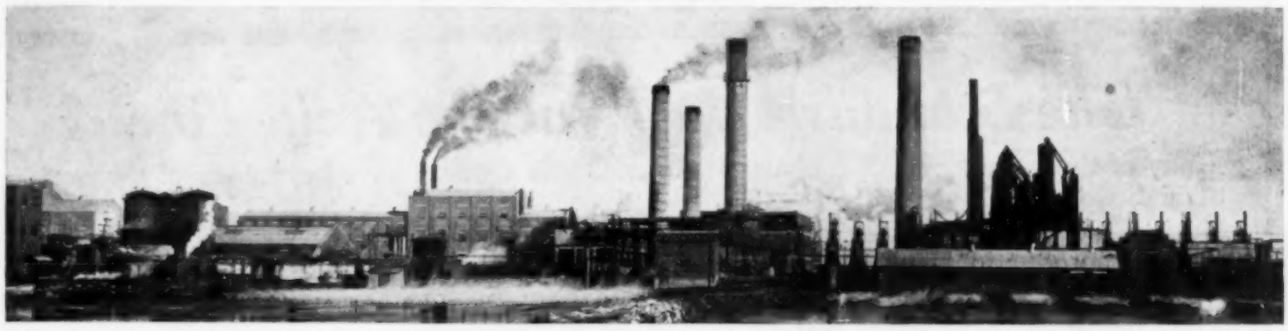

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Your Daily Job And Technical Progress

ONE of the largest newspapers in the country publishes on the editorial page two or three economic goals toward which the paper editorially is striving.

It's rather a good idea, for it keeps the reader's mind focussed on long-time progress. It makes perspective more accurate. It tends to eliminate ruts.

Perhaps it would be a good thing to be reminded of certain important phases of chemical engineering that *Chem.* & *Met.* is striving to emphasize, such as:

Unit processes—the very vitals of chemical engineering
Industrial heating
Material handling
Use of refractories
Corrosion elimination

Are you thinking about these things?

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Searchlight Section, 33-35; Professional Directory, 36; Ready Reference, 38-40; Alphabetical Index, 42

DURIRON *The* Universal Acid Resistant

DURIRON ACID PROOF TRADE MARK

The Standard Cock for the Acid Line

Many of the largest chemical plants of America and Canada have been users of Duriron Straightway Plug Cocks for years.

During the World War, when expansion of the chemical industry was abnormal, the increased production was materially aided by this dependable cock, and the continuance of use is because there has not been found any other equipment or material its equal.

The immense resistance of Duriron both to corrosion and erosion results in the maintaining of clean surfaces on this cock, allowing free movement and keeping tight joints.

The cock is right mechanically. The plug has the proper taper. The gland may be tightened without binding. The packing ring bearing surface is accurately ground. There are ports at the bottom to prevent an accumulation of solids in the bottom of body. All parts are accurately ground to gauge, thereby being interchangeable and replaceable. Plugs are readily lapped in by grinding with emery flour and oil or water. All parts are Duriron except packing gland, bolts and split flanges.

Where this equipment is subjected to unusually rough treatment, we suggest the block type of installation, which only puts the cock into compression. This applies only when connected to lead or screwed pipe.

Duriron Three-Way Cocks are essentially similar to the Straightway, and greatly simplify the arrangement and design of carrying systems.

TABLE OF DIMENSIONS
Duriron Straightway Plug Cocks

Size	Face to Face of Flanges	Overall Height
⅜"*	2⅜"	5 5/16"
½"*	4¼"	4 11/16"
¾		
1"	5¼"	5 5/16"
1¼"	6½"	6 7/16"
2"	7½"	8 5/16"
2½"	8½"	8 15/16"
3"	9½"	10 11/16"
4"	11½"	12¼"

* Block Type Only.

TABLE OF DIMENSIONS
Duriron Three-Way Plug Cocks

Size	Face to Face Opposite Flanges	Center of Run to Face of Side Outlet Flange
1"	7"	4¼"
1½"	8"	5"
2"	9"	6"
3"	11"	7¼"
4"	11½"	7¾"

The DURIRON COMPANY
DAYTON · OHIO

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CHICAGO
110 South Dearborn St.

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576 Monadnock Bldg.

Two sticks stronger than one

EVERY engineer knows that two sticks bound together are stronger than one of equal dimensions. So, likewise, Linde's 115 plants and warehouses can offer a more dependable delivery service than could one gigantic plant and warehouse.

Remember this when you sign a contract for oxygen. Is it a contract that has back of it Linde's 115 plants and warehouses, bound firmly together by a determination to give the customer perfect service?

A Linde contract will also bring you each month "Oxy-Acetylene Tips" to help you make your oxy-acetylene equipment more useful.

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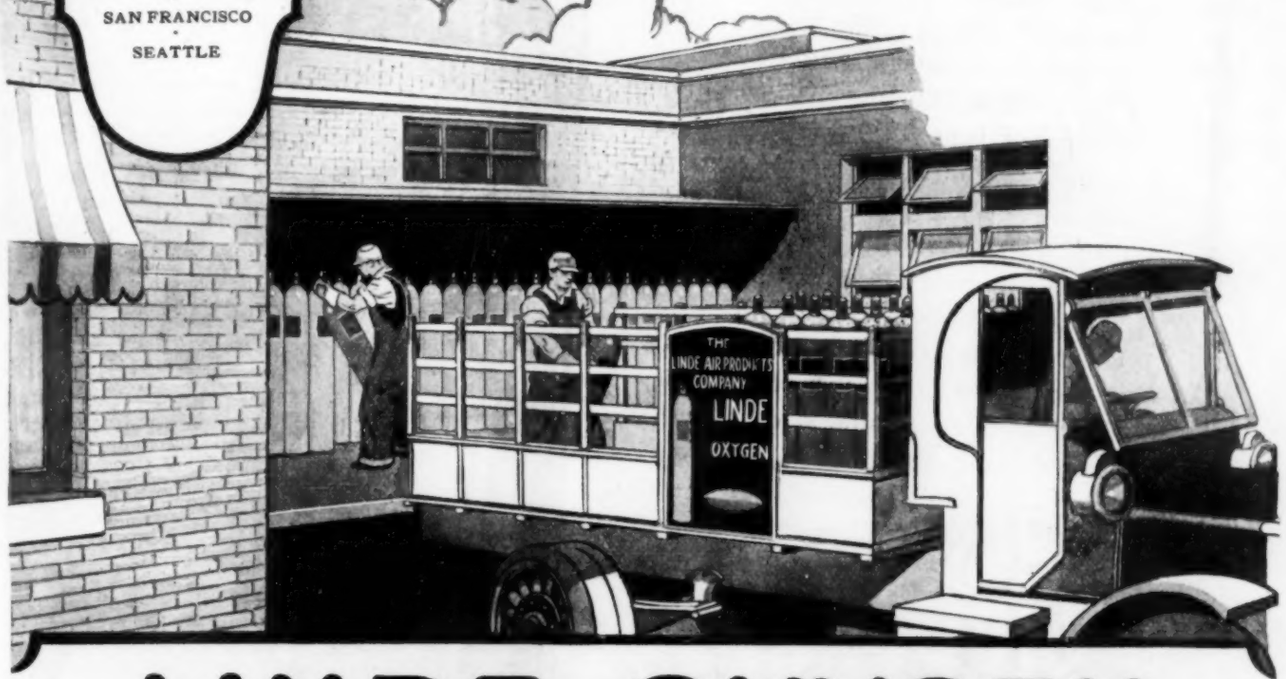

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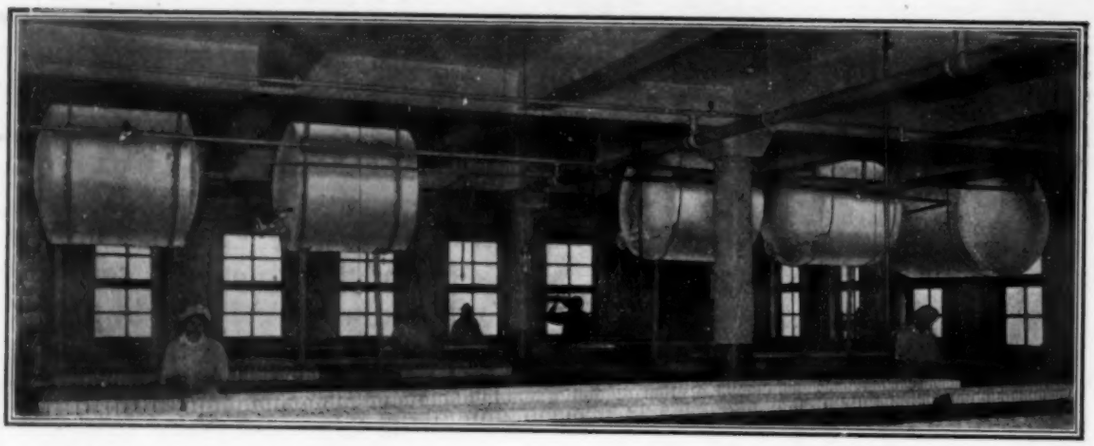

Battery of Pfaudler Glass Lined Horizontal Tanks suspended from ceiling. These are used by a large eastern proprietary manufacturer as filling tanks in the bottling of medicine.—One of the many applications of Pfaudler Glass Lined Equipment.

Pfaudler
Glass Lined Steel Equipment

Effective Immediately

Announcement to the Trade

The Pfaudler Co. announces that it has purchased all of the assets of The Elyria Enameled Products Co., of Elyria, Ohio. The purchase was consummated June 3, 1924, and it is the intention of The Pfaudler Co. to continue operation in the Elyria factory, which will be known as The Elyria Enameled Products Division. The production of Elyria Equipment will be continued, and all of the staff of the Elyria Co. have been retained. With bigger production made possible through the operation of both factories, even better and more complete service than heretofore, will be given.

When the chemical industry was still an infant, as compared to the giant of today,—when such industries as artificial silk, insulin, and a score of others were still ideas, and some of them not that,—when old-line firms like du Pont, Eastman Kodak, Procter and Gamble, and United Drug, had not yet quite caught their stride—Pfaudler was doing business at Rochester, N. Y.

Equipment put out by us in the 90's is still doing service, long ago having paid its debt to its owners.

And with this mutual "growing up" process, we have come to feel that we have had a definite part in the upbuilding of the chemically controlled industries of America.

Some of our skill has indirectly aided the skill of those pioneer workers who have laid the groundwork of true American chemistry, and continued in its development.

It is with pleasure that we make the announcement at the left, as it means the added opportunity of bigger and better service.

We solicit your inquiries on all types of glass lined equipment, orders for which will be filled from either factory, depending on location of customer.

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THE story of a machine which saves money. For all plants—small, medium, and large. A simple machine. A reliable machine. An efficient machine. One which reduces operating and production worries.

SIMPLICITY—the true test of a designer's ability. A machine that is simple is also easy to operate. Experienced labor is not required. There are no complicated mechanisms. Interruptions in production schedules are avoided.

(*Continued in the next issue.*)

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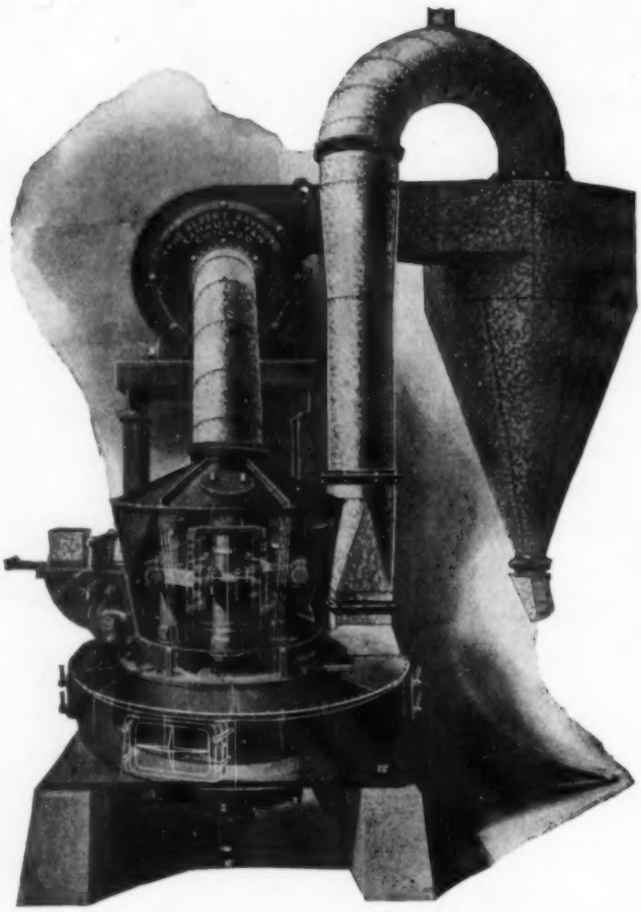

Four Roller Low-Side Mill equipped with Air Separator, Exhaust Fan, Cyclone Collector and Galvanized Piping

The following data have been given us by the Superintendent of one of the 35 Gypsum plants which are using Raymond machinery. We will gladly furnish his name and address on request.

This plant is using 3 Raymond Low-Side, Four Roller Mills with air separating equipment. Two of these were installed in 1912—the third in 1922. They produce from 92 to 95% material that will pass through a 100 mesh.

The superintendent says:

"The output of each of our Raymond Mills average 10 tons an hour right along. This is considered very high. Other mines in this neighborhood using other types of pulverizing machines get only about 7 tons an hour as a maximum. We are using the machines severely. They often run 22 hours per day. In 1922, a 22 hour schedule was maintained from March to December.

The two mills bought in 1912 had one complete overhauling since they were installed and are now as good as new.

Maintenance and repairs are estimated at $1200 per year per mill. This covers everything—repairs, replacements of metal pipe and collectors, maintenance, labor and an allowance for a complete overhaul every five or six years.

When operating 22 hours per day, the cost per ton of product is $.2036 per ton."

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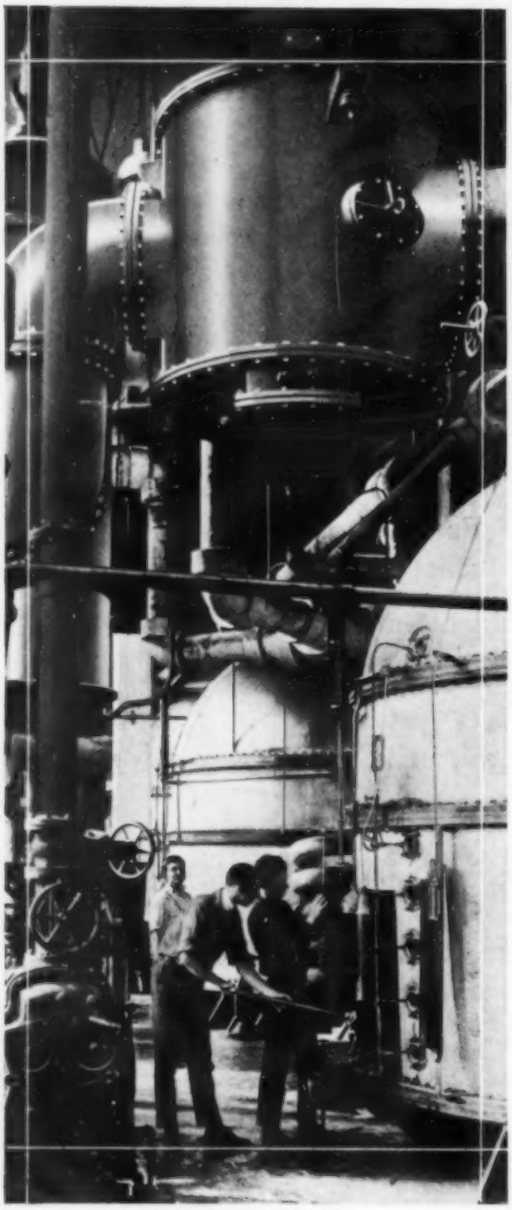

Behind the scenes in a sugar factory.

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It takes more than correct design to make processing equipment function as it should.

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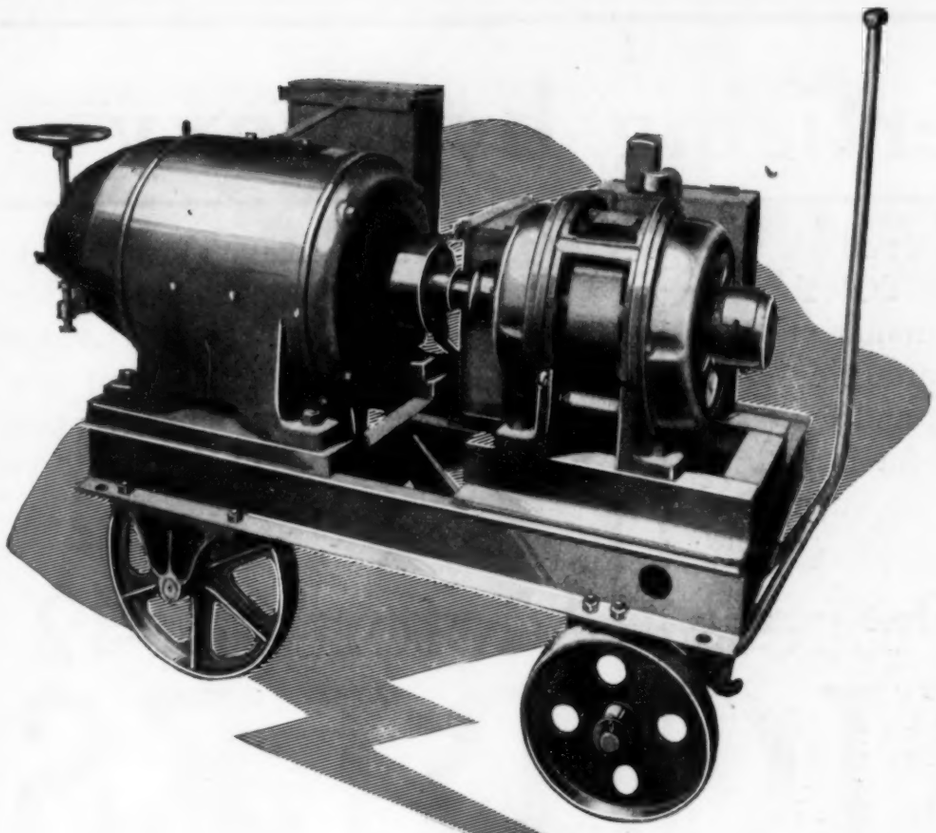

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This welder gives 24-hour service, day after day.

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The WD-12 Arc Welder

—operates on any commercial voltage, phase or frequency.

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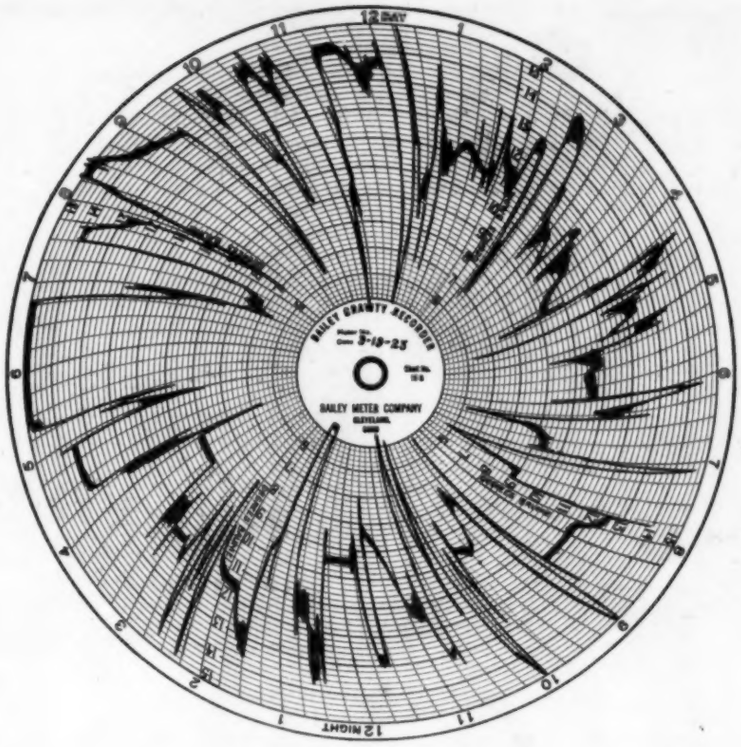

BAILEY GRAVITY RECORDED TYPE S5
With Pump for Circulating Sample
Drawn from Tanks, etc.

Of What Practical Use Would Hydrometer Readings Be in a Case Like This?

Readings would have to be taken every few seconds to measure such extreme variations in gravity as this chart of the Bailey Gravity Recorder shows. But they are not so taken. And when they are taken, what assurance have you that these readings may not skip some of the "valleys" and "peaks" of these gravity changes? None.

This is a gravity record of caustic soda at 120 deg. F., before it reached the filter and mixing tanks preceding the digesters in a paper mill. The record shows the extreme variations in gravity resulting from the emptying of tanks of caustic of various strengths.

Try out these Recorders in your process work. Bulletin 191 describes them completely.

BAILEY METER COMPANY

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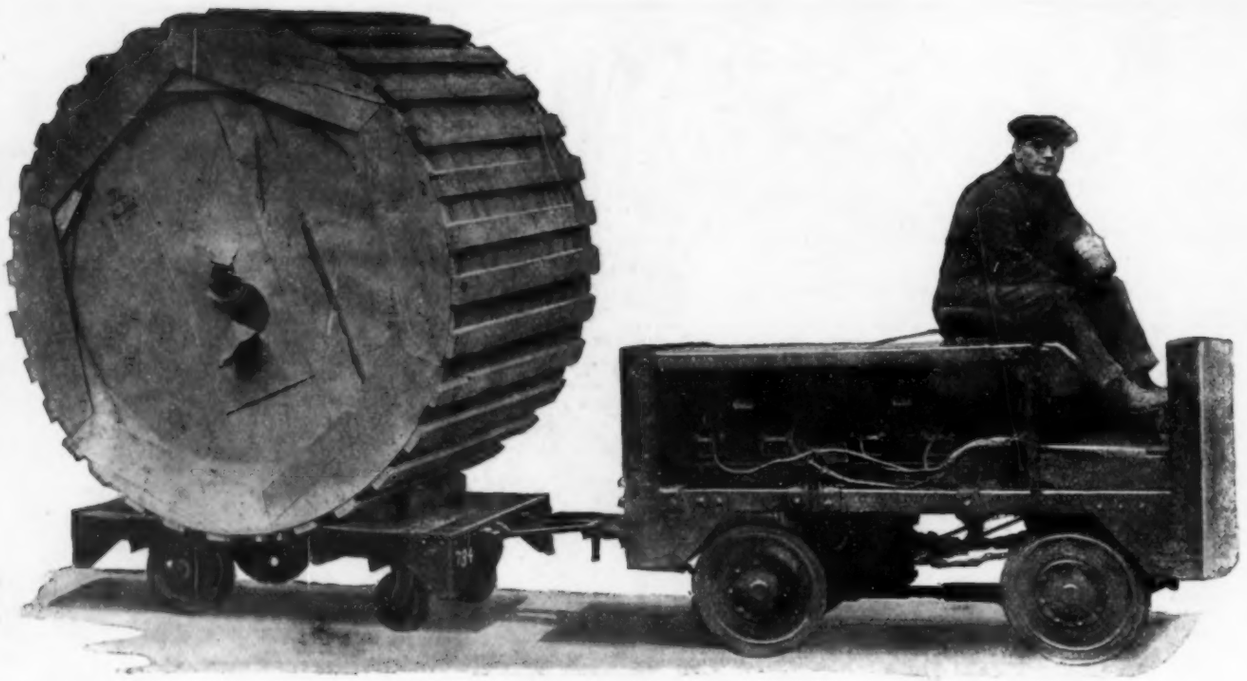

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Of the millions of feet of belting that left our factory in 1923, adjustments on imperfect belts amounted to less than ⅛ of 1 per cent!

The whole tremendous output of Goodrich Belting was 99.87 per cent PERFECT.

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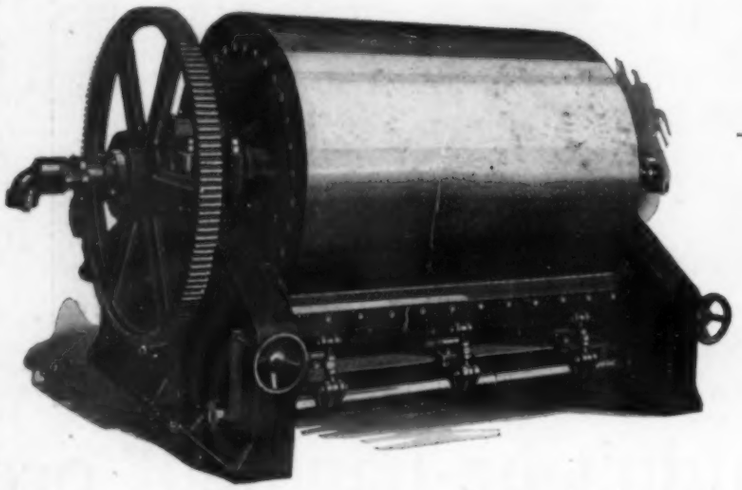

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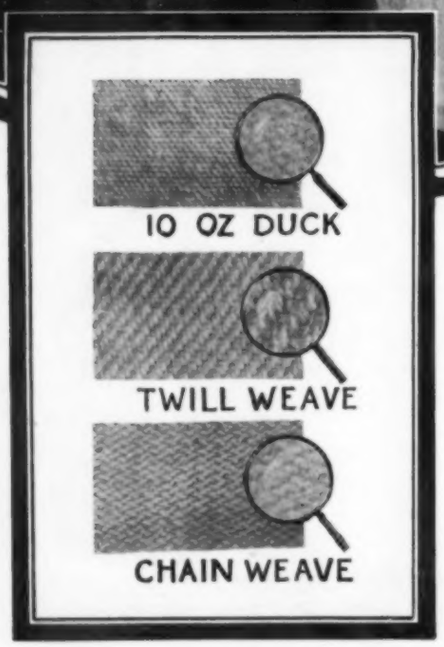

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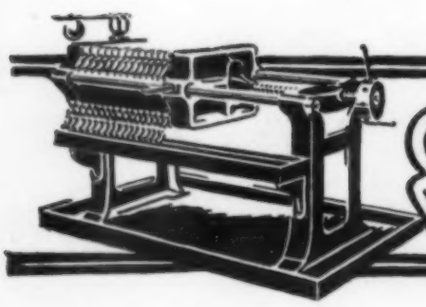

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FAHR-ITE

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Plants at Springfield, Lima, Bucyrus, Ohio

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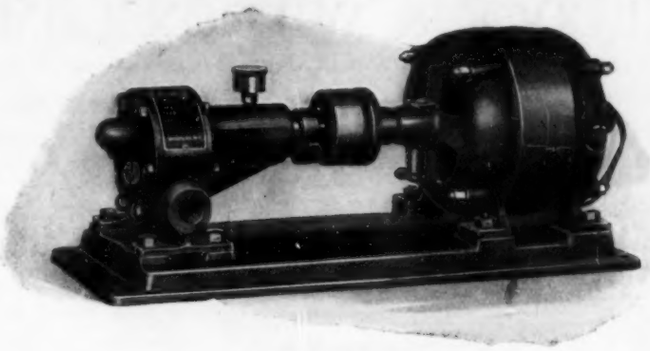

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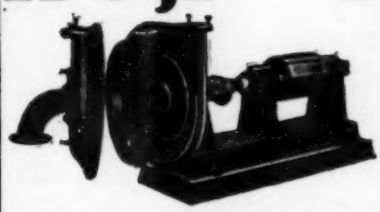

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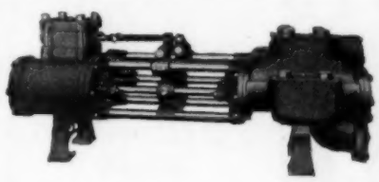

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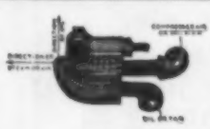

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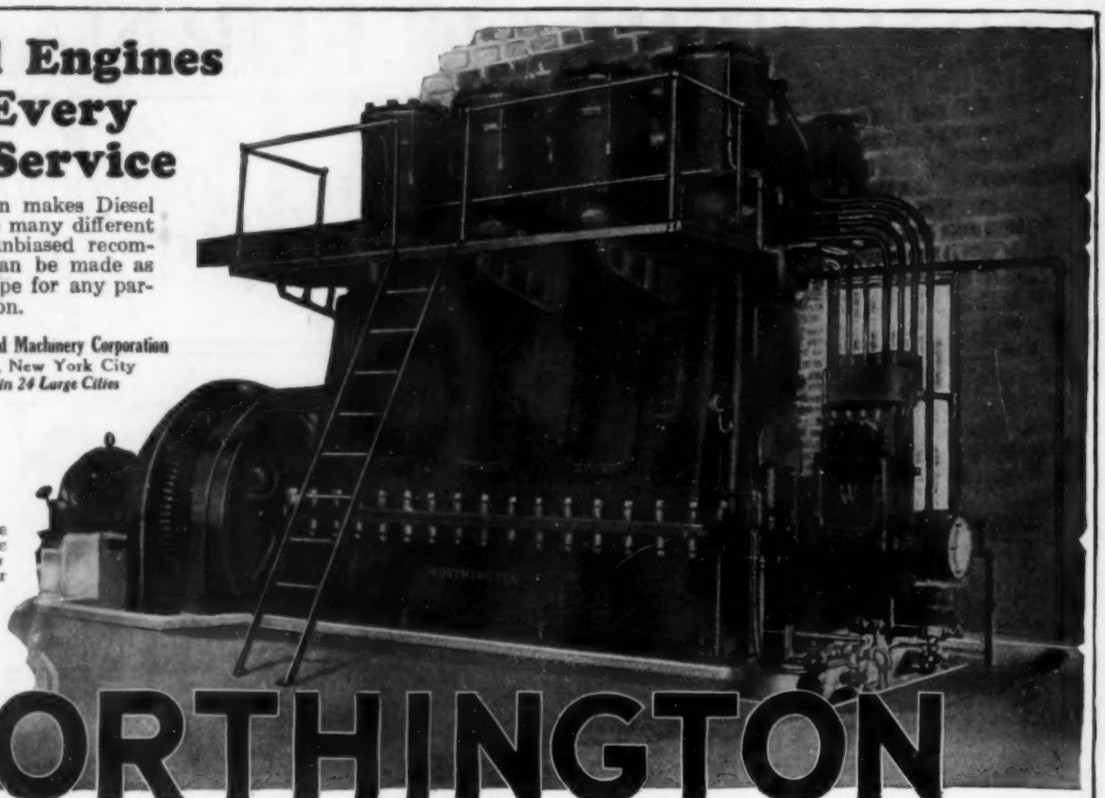

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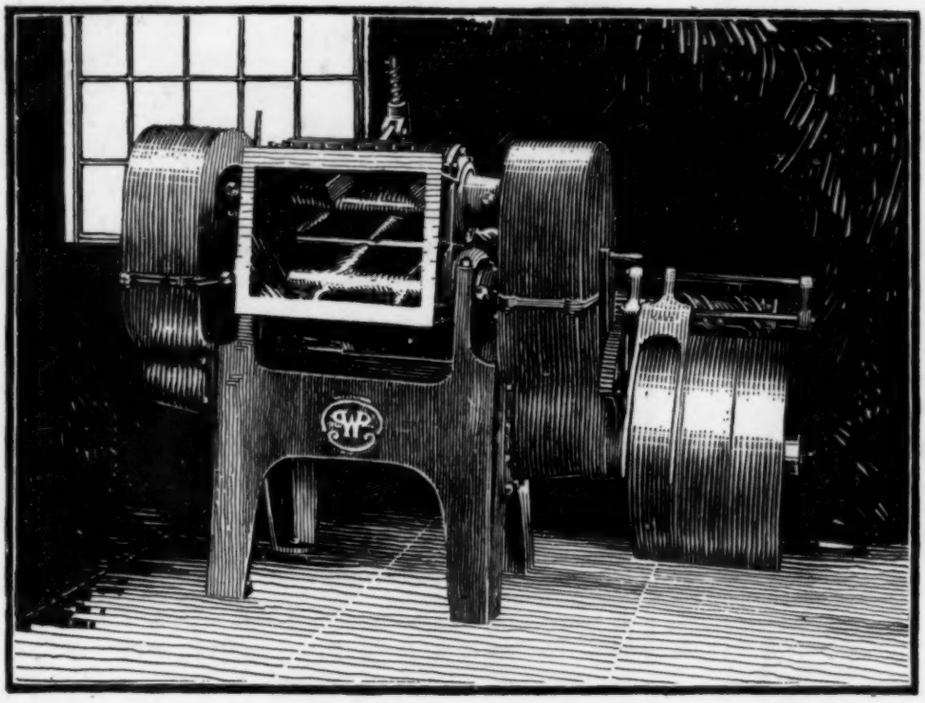

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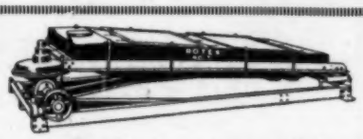

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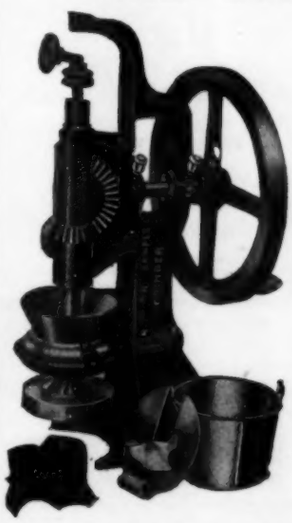

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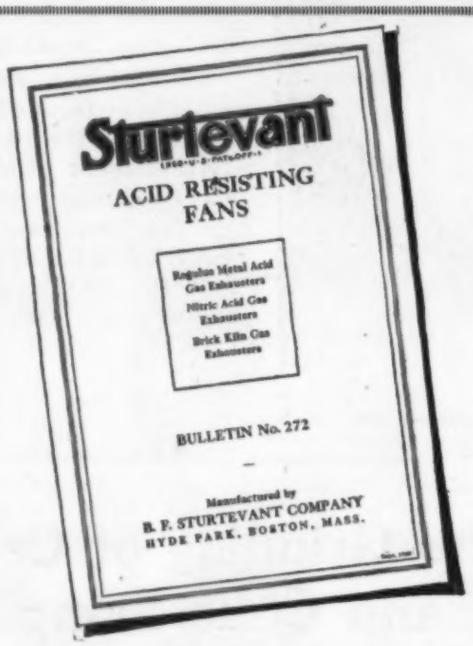

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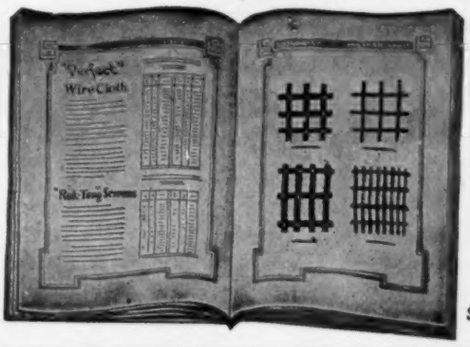

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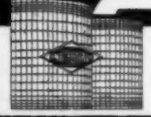

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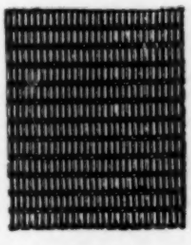

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808 Hamilton St., Harrison, N. J.

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FOR NEARLY ALL MATERIALS

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Direct, Indirect and Steam-Heated
SIX TYPES—SIX SIZES
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FJS **Rotary Vacuum Dryers**
Atmospheric Drum Dryers
Impregnating Apparatus FJS
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Industrial Heating by Oil Circulation by the MERRILL PROCESS
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500 installed during the past eight years attest the supremacy of Morgan Producer-Gas Machines. Their RELIABILITY makes permanent friends everywhere.
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For Chemicals
DIRECT HEAT DRYERS
We handle waste and by-products
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Not far from you there is a Morehead Back-to-Boiler System draining the condensation from all steam-heated surfaces and returning it to the boilers as feed water at temperatures up to 300 degrees F.

It is giving them hotter surfaces, greater output and bigger profits.

It is saving fuel.

A Morehead System will accomplish the same for you. If condensation clogs and cools your heating surfaces—if your production is low and coal bills too high, we can show you the remedy. Profit from the experience of your neighbor. Write for information.

Morehead Manufacturing Co.
Dept. J, Grand River Ave. at Warren
Detroit Michigan

Morehead
"BACK-TO-BOILER-SYSTEM"
POSITIVELY DRAINS ALL TYPES OF STEAM APPARATUS DELIVERS CONDENSATION AND FEED WATER TO BOILERS UNDER ALL CONDITIONS AT MAXIMUM TEMPERATURE
(129)

SELF-BALANCING—CENTER SLUNG
SOLID CURB—SUSPENDED
CRANE TYPE SUSPENDED

Baskets 12-72 inches in diameter

Perforate or imperforate baskets with or without bottom discharge.

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TOLHURST MACHINE WORKS ESTABLISHED 1852. TROY, N.Y.

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SINGLE OR MULTIPLE EFFECT
ANY CAPACITY ANY SOLUTION

Heaters — Causticizers
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Heat Exchangers — Water Stills
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Soda Recovery Plants

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For All Purposes
ORIGINAL — STANDARD
Established 1843
AMERICAN TOOL & MACHINE COMPANY
Trade Mark Registered U. S. Patent Office
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MOTOR—BELT—STEAM TURBINE DRIVE
Every Size and Every Type for Every Purpose
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Established 1901
JOHN F. ABERNETHY
Lead Burning
Chemical Lead Work of Every Description
Lead Linings for Tanks, Kettles, etc. — Lead-Lined Tanks
Pure Tin Linings for Vessels of Every Character
Lead Pipe Coils of Every Description
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How about the PLATINUM WARES?

In most college and university laboratories after the hard usage of the year, the platinum wares usually need attention.

Reshaping or remaking, at any time adds to their length of service. Having it done at this time means an available supply of Platinum ready for use at the fall opening.

THE APW METHOD

Of remaking means the use of Specially Refined Platinum. Hammered by Hand.

It means a prompt, satisfactory and efficient service at a nominal cost.

Now is the time to look over your wares. Then send them to us for reshaping or remaking. If desired we will hold them until fall opening.

If first required—we will gladly send estimates.

AMERICAN PLATINUM WORKS
N. J. R. R. Ave. at Oliver St., Newark, N. J.
New York Office—Charles Engelhard, 30 Church St.

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REG. U.S. PAT. OFF.

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ACID-PROOF TOXEMENT

An integral compound with a double purpose. It both waterproofs and acid-proofs walls, floors and tanks containing chemicals.

There's a scientific "R.I.W." Product for each purpose of surface protection.

Write Department T for information.

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Opposite the Grand Central Terminal
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NELSON CELL
Increases Electrical Efficiency
Improvements on Practical Operation
Write for details
The Warner Chemical Company
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Knowles Electrolytic
HYDROGEN
Cells for Any Output

Plants supplied and ordered during the past year include:
3 for oil hardening
2 for rare metal refining
1 for synthetic ammonia

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FIRE CEMENT
"Makes the Weakest Point the Strongest"
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KROMEPATCH
STICKS TO THE BRICK
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A Neutral Refractory Cement That Prolongs the Service Life of Furnace Linings

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The Paint that is setting new Permanency Records! Write for interesting facts.

The Nitrose Company
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For every process where heat is a factor
Brown Pyrometers
Most used in the world

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Quick Growth of Pulp Supply in Alabama

Cut over lands in Alabama offer unlimited possibilities for the regrowth of pulp supply.

Low, marshy lands along Alabama rivers—the Warrior, Coosa, Tallapoosa, and Tennessee afford a plentiful supply of rapidly growing gum woods.

On Alabama hillsides and in her river valleys other types of hard and soft woods—notably a vast expanse of pine forests covering 15,500,000 acres and estimated to contain 23,316,400,000 merchantable pine stand feet are found.

This Southern Pine Belt was recently characterized by a national authority as—

> *"The greatest single asset in the way of a potential source of coniferous wood existing anywhere on the face of the earth."*

In addition to the almost unlimited supply of coniferous woods now standing, repeated tests have proved that—

Timber Will Regrow to Pulp Size in Alabama in Twenty Years

and also that—

The growth of two cords of wood per acre may be obtained on Southern lands under proper forestry management.

Hydro-electric power now available to the amount of 600,000 horsepower, accessibility to markets in the Middle West and shorter hauls to those of the New England states, a mild climate, adapted to year around logging operations, and a bountiful supply of native labor—are the other factors which are pointing the way to **VIRGIN ALABAMA WOODLANDS** as a practically untapped source of raw materials for the pulp and paper making industry as well as the quick replenishment of pulp supply.

For further information on PAPER MAKING IN ALABAMA write the Alabama Power Co., Commercial Department, Brown-Marx Bldg., Birmingham, Ala.

ALABAMA POWER COMPANY
BIRMINGHAM, ALA.

SEARCHLIGHT SECTION

USED EQUIPMENT & NEW—BUSINESS OPPORTUNITIES

UNDISPLAYED—RATE PER WORD:

Positions Wanted, 4 cents a word, minimum 75 cents an insertion, payable in advance.

Positions Vacant and all other classifications, 8 cents a word, minimum charge $2.00.

Proposals, 10 cents a line an insertion.

INFORMATION:

Box Numbers, in care of any of our offices count 10 words additional in undisplayed ads.

Discount of 10% if one payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

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Rates for larger spaces, or yearly rates, on request.

An advertising inch is measured vertically on one column, 3 columns—30 inches—to a page.

C.&M.

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OPPORTUNITY. Can you manufacture vegetable glue? Can you run a modern vegetable glue plant? If so write us. P-937, Chem. & Met. Engrg., Old Colony Bldg., Chicago, Ill.

WORKS chemist wanted for large chemical manufacturing plant near New York. One who can take complete charge of all control work and do a certain amount of research work at the same time. The position requires a man of executive ability as he will have a staff of chemists working under his direction. P-959, Chem. & Met. Engrg., 10th Ave. at 36th St., New York.

EMPLOYMENT SERVICE

SALARIED men seeking tentative offers of new connections, are invited to communicate confidentially with the undersigned, who will negotiate overtures without jeopardy to present connections. A professional, ethical service, restricted to high grade positions; established 1910. Retaining fee refunded as provided in our "Refund Contract" if service is not satisfactorily rendered as per contract, and such refund be requested within three months from date remitted. Send name and address only for particulars. R. W. Bixby, Inc., 706 Lockwood Building, Buffalo, New York.

EXECUTIVES, engineers, $3,000-$25,000, will find our individual, confidential service an effective medium in making new connections. Personally conducted by Mr. Jacob Penn, the eminent employment authority, known to leading business men through America. Our refund agreement protects you. Not employment agency. Jacob Penn, Inc., 305 Broadway, New York.

EMPLOYMENT AGENCY

GENERAL ENGINEERING AGENCY, Monongahela Bldg., Pittsburgh, Pa. Require for transcontinental distribution among employers, metallurgists, chemists, designing engineers, laboratory executives, assistants. Steel inspectors, mine engineers, cadets.

POSITIONS WANTED

CHEMICAL and metallurgical engineer, university graduate; varied industrial experience in inorganic and non-ferrous metallurgical work (some organic), as chemist, chief chemist and superintendent; excellent scientific and business training. PW-947, Chem. & Met. Engrg., Old Colony Bldg., Chicago, Ill.

CHEMICAL engineer, 30, nine years' experience, largely on dye intermediates, partly on cracking processes for gasoline, capable of handling process development from laboratory through to finished plant product, experienced in handling men and building up a producing organization. Has use of a laboratory. Willing to undertake all or part time work. PW-963, Chem. & Met. Engrg., 10th Ave. at 36th St., New York.

DEVELOPMENT chemist; age 30; single, gentile, Protestant, Mid-Western university graduate, 1921; analytical and development experience in rubber, water, coal, coke, oils and steel; good correspondent; sound business judgment; some sales ability; Central or Southern states preferred. Address PW-950, Chem. & Met. Engrg., Old Colony Bldg., Chicago, Ill.

POSITIONS WANTED

ENGINEER, mechanical, 32, fourteen years' broad experience with large industrial corporation, desires responsible connection as plant, works or mechanical engineer or assistant; sales or representative engineer; member Am. Soc. Mech. Engineers. PW-935, Chem. & Met. Engrg., 10th Ave. at 36th St., New York.

GRADUATE chemist, seven years' experience organic research and manufacture. Thorough knowledge of synthetic resins and plastics. PW-964, Chem. & Met. Engrg., Real Estate Trust Bldg., Phila., Pa.

RESEARCH director. Extensive invention record with broad legal experience in patents and contracts. Able negotiator. Experienced in colloids, organics, drugs, pharmaceuticals, cellulose derivatives, textile and sanitary chemistry. Very high references for chemical skill, practical thought and business capacity. Desire position in research and development or consultation. PW-965, Chem. & Met. Engrg., 10th Ave. at 36th St., New York.

YOUNG man, graduate chemist, 3 years' experience in plant work, also in refining and assaying precious metals. Desires opportunity to show executive ability and initiative. PW-962, Chem. & Met. Engrg., 10th Ave. at 36th St., New York.

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Financial and Active Combination Desired

Company with chemical plant in Pittsburg district will consider combination both financial and active with other company or individual now active in some prosperous chemical or allied line. Plant is well equipped with boilers, tanks, filter presses, pressure tanks, etc., and can be used for almost any chemical purpose. BO-872, Chem. & Met. Engrg., Real Estate Trust Bldg., Philadelphia, Pa.

Wanted to Hear from

engineering or manufacturing individual or firm who would be interested in handling on mutually satisfactory terms the proposal, design or construction of dry gas cleaners which are applicable to ferrous, non-ferrous and non-metal dust recovery problems and inquiries on which are already in hand. BO-954, Chem. & Met. Engrg., Real Estate Trust Bldg., Phila., Pa.

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PLATINUM SCRAP

IN ANY FORM

We pay highest market price, make prompt returns and hold goods for your approval.

I. MILLER, Smelter and Refiner,
252 Colonial Arcade, Cleveland, Ohio.

WANTED

REVOLVING STEAM JACKETED DRYER

8 ft. in diameter, 18 ft. long.
Please state price and where same can be inspected. Address replies to

W-961, Chem. and Met. Engineering
10th Ave. at 36th St., New York City.

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3—Sweetland Filter Presses.
1—Oliver Filter Press.
3—Centrifugal Machines.

Also

Alcohol and Chemical Equipment.

W-945, Chem. and Met. Engineering
10th Ave. at 36th St., New York City.

Surplus Equipment at Attractive Prices

Write for Complete List and Quotations

AUTOCLAVES

5—C.S., 36x36x2 in. jacket.
3—C.S., 21½x84x1 in.
1—C.I., 42x68x3 in.
2—C.I., 48x48x1½ in.
2—C.I., 48x72x5 in.

CENTRIFUGALS

4—30-in. American, Steel and Copper Baskets.
4—36-in. American Tool—Brass Basket.
1—36-in. Shell.
1—36-in. Basket.
1—42-in. Basket.

CRUSHERS—ICE

1—Creasey No. 152 Hopper—15½x19½ in.
1—Creasey No. 57 Hopper—15x8 in.
1—Creasey No. 150 Hopper—29x30 in.

COLUMNS

1—C.I. Fractionating—3 ft. 0 in.x16 ft. 6 in.
1—C.I. Fractionating—4 ft. 0 in.x14 ft. 8 in.
1—C.I. Fractionating—40 in.x10 ft. 0 in.

DRYERS

1—Ruggles-Cole Rotary Steam 4 ft. 0 in.x20 ft. 0 in.
1—Devine Atmospheric—2-roll—4 ft. 0 in.x9 ft. 0 in.

FILTER PRESSES

1—8x6 ft. Oliver.
1—18-in. Johnson.
1—No. 3 Sweetland.
3—Kellys Nos. 20, 150, 250.
20—Filter Presses—Wood and Iron—12 to 36 in.

KETTLES

1—Steel 30x26x⅜ in. jacket, lead lined.
1—Steel 30x30x⅜ in. jacket.
1—Steel 36x36x⅜ in. jacket.
1—Steel 24x30x⅜ in.
1—Steel 30x42x½ in.
1—Steel 36x24x⅜ in.
6—C.I., 90x96x1½ in. cone shape dumping.
1—Steel Open Top Enamel Lined—16½x15 in.
2—Steel Open Top Enamel Lined—28x18 in.

KETTLES—Continued

2—Steel Open Top Enamel Lined—30x22 in.
1—Steel Open Top Enamel Lined—36x24 in.

MISCELLANEOUS EQUIPMENT

3—Reduction Gears—5 to 1 Ratio.
2—36-in. Disintegrators.
1—Sharpless Separator 12x57 in.
1—American Radiator Boiler, 8-section, 1500 sq.ft.
1—Lining for 3 ft. 0 in.x5 ft. 0 in. Ball Mill.
1—Dorr Causticizing Unit.
10—Peerless Radiators
2—9000 lb. Electric Elevators.
Miscellaneous Chemicalware Details.
Miscellaneous Pipe Coils.
Surface Condensers.
1—Steel Stack, 48 in. dia. x 70 ft. high.

BALL MILLS

2—Tile lined 18x24 in.
3—Unlined 6x5 ft.
1—Unlined 6x10 ft.

MIXERS

1—Day 12x12x42 in.
1—Day 36x36 No. 869.
1—Read 36x24x24 No. 7539.

PUMPS

2—Blake Knowles Vacuum 12x12 in.
1—Wheeler Vacuum 4x10x8 in.
1—Gould Vacuum 5x4 in.
5—Worthington Duplex Steam—5¼x4¾x5.
3—Columbus Duplex Steam—6x4x6.
6—Rumsey Triplex 1½x4 in.
2—Worthington Triplex 4x6 in.
1—Worthington Duplex 9x14x8½x10.
1—American Cent. Type N.T.M.B., 10-in. discharge.

TANKS

3—Vertical Steel 10 ft. 0 in.x20 ft. 0 in.
6—Vertical Steel 10 ft. 0 in.x12 ft. 0 in.x½ in.
3—Horizontal Steel 7 ft. 0 in.x16 ft. 0 in.x⅜ in.
4—Horizontal Steel 6 ft. 10 in.x28 ft. 7 in.x⅜ in.

E. I. DU PONT DE NEMOURS & CO., INC.

Dyestuffs Department
Room 9096 Du Pont Building, Wilmington, Delaware.

WE OFFER FROM OUR OWN STOCK:

DRYERS
12—Vacuum Shelf Dryers, 27, 23, and 11.
2—Bronze Vac. Drum Dryers, Devine, 40-80 in.
1—4x30-ft. American Process Rotary Dryer.
1—4x20-ft. Rotary Vacuum Dryer.
2—5x33-ft. Rotary Vacuum Dryers.
1—4x 8-ft. Atmospheric Drum Dryers.
1—4x10-ft. Atmospheric Double Drum Dryer.
5—Gordon Shelf and truck type Dryers.

DISTILLING APPARATUS
2—60-in. Copper Column Units.
1—60-in. Copper Beer Still, complete.
15—Copper and C. I. Columns from 10 in. to 60 in., complete.
5—Copper Vacuum Stills, 30, 75, 300 gal.
6—Aluminum Stills, 100 gal.

FILTER PRESSES
9—Sweetland Nos. 12, 10, 9, 7, 5 and 1.
9—Kelly Nos. 850, 450, 250, and 150.
1—Oliver all Iron, 4x6 ft.
1—Industrial, 6x6 ft. 2—Oliver, 6x6 ft.
30—Filter Presses, Wood and Iron, all types, complete, from 12 to 42 in.

CENTRIFUGALS
2—36-in. Steel Baskets. 3—36-in. Cop. Bkts.
5—26-in. Copper Baskets. 1—28-in. Cop. Bkt.
2—36-in. Bronze Baskets.
17—Copper and Steel, over-driven and under-driven Extractors, complete, from 12 to 60 in.

REFRIGERATING PLANTS
6—Brunswick & York, 2, 4, 6, 8 and 10 ton.

KETTLES, JACKETED
25—80-gal., aluminum.
120—Jacketed Kettles, Iron, Copper and Steel, from 25 to 1200 gal.
3—800-gal. Cast Iron Kettles.
1—1000-gal. Nitrator.
15—Nitrators and Sulphonators, complete, from 50 to 1500 gal.

GRINDERS AND PULVERIZERS
Raymond Mills—1-0000, 1-000, 3-00.
1—20-in. Schutz-O'Neil.
2—4x16, Silex, Lined Tube Mills.
2—3x3½, Silex Lined Ball Mills.
1—30-in.x20-ft. Pebble Mill.

WERNER AND PFLEIDERER MIXER
7—Size XV, 100 gal.
2—Size XVII, 200 gal.
1—100-gal. Vacuum Mixer.
1—20-gal. Laboratory Mixer, complete.

MISCELLANEOUS ACID EQUIPMENT
8—General Ceramic Stoneware 12-in. Blowers, new.
1—Glens Falls Sulphur Burner, 4x16 ft.
1—Glens Falls Sulphur Burner, 30 in.x8 ft.
25—Tons of Assorted Duriron, Pipe and Fittings, new.

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Phone Barclay 0603
Wire—Phone—Write

Cable Address, Equipment
15 Park Row, New York City

FOR SALE

Machinery

1—1400 gal. **Reduction Kettle.**
1—1100 gal. **Jacketed Sulphonator.**
2— 700 gal. **Jacketed Sulphonators.**
1— 400 gal. **Jacketed Stokes Mixer.**
3— 400 gal. **Day Jumbo Mixers.**
1— 350 gal. **Steel Mixer.**
1— 300 gal. **Duriron Jacketed Mixer.**
2— 300 gal. **Dopp Mixers.**
2— 300 gal. **Jacketed Mixer Kettles.**
2— 150 gal. **W. & P. Jacketed Mixers.**
1— 150 gal. **Horizontal Mixer.**
1— 40 gal. **Ross Mixer.**
1— 150 gal. **Copper Jacketed Still.**
9—**Aluminum Stills;** 115—80 gals.
7—80 gal. **C. I. Jacketed Stills.**
1—70 gal. **Jacketed Copper Still.**
1—**Vacuum Shelf Dryer,** 5 shelves.
2—**Devine Dryers,** 13 shelves.
2—**Devine Dryers,** 20 shelves.
1—**Rotary Dryer,** 32 in. x 8 ft.
2—30 in. sq. **Wooden Filter Presses.**
2—24 in. sq. **Cast Iron Filter Presses.**
1—18 in. sq. **C. I. Filter Press.**
2—18 in. sq. **Wooden Filter Presses.**
90—**Aluminum Kettles,** jacketed; capacities 40, 60, 80 and 100 gals.
25—**Jacketed Dopp Kettles;** 60, 75 gals.
2—30 gal. **Enameled Jacketed Kettles.**
2—150-hp. **Bridgeport Boilers.**
1—120-hp. **H. R. T. Boiler.**
1— 30-hp. **Upright Boiler.**
1— 20-hp. **Upright Boiler.**
1— 14-hp. **Upright Boiler.**
2— 7-hp. **Upright Boilers.**
12—**Ore Concentrators,** 2 ft. wide x 4 ft. high x 5 ft. long; practically new.

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3—Dorr re-action tanks, 10x10-ft., complete with agitators and steam coils.

Price and specifications on request.

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Old Hickory, Tennessee.

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4—Baker & Shevlin Centrifugal Screens. Size No. 1.

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All Equipment of the Former

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Dryers
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Detailed Description Upon Application

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1—4x10-ft. Perin Atmospheric Double Drum Dryer (Practically New).

1—13-in. Devine Kek Grinding Mill (New).

1—No. 0, Style B, 20-in. x 7-ft. Barnard-Lease Centrifugal Reel (New).

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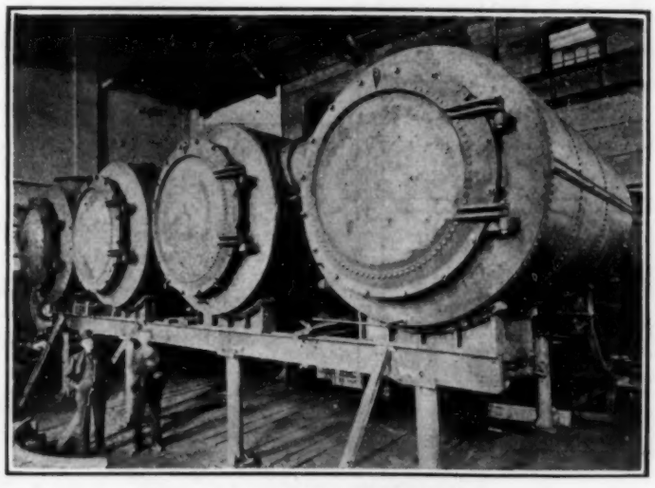

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One ANSONIA All Copper Evaporator

Three ZAREMBA All Copper Evaporators

Three Quadruple Effect LILLIE Evaporators

All Cast Iron With Copper Tubes

Write for Prices and complete specifications

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Continued from Page 35

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Figure 275.
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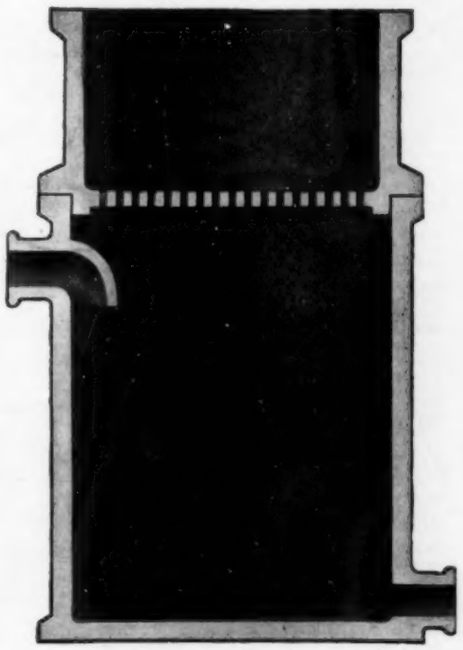

Figure 286.
Acid Proof Suction Filter "B"

Figure 226-B.
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American Platinum Works
Baker & Co., Inc.
Bishop, J. & Co., Plat. Wks.
Roessler & Hasslacher Chem. Co.

Porcelain Ware
Coors Porcelain Co.

Potash
Du Pont de Nemours & Co., Inc.

Power Plant Equipment
General Electric Co.
Steere Engineering Co.

Power Transmission Machy.
Valley Iron Works

Precipitated Chalk
Industrial Chemical Co.

Prussiates
Du Pont de Nemours & Co., Inc.

Pulleys, Cast Iron
Dodge Manufacturing Corp.

Pulleys, Magnetic
Dings Magnetic Separator Co.
Magnetic Mfg. Co.

Pulverized Coal Equipment
Raymond Bros. Imp. P. Co.

Pulverizers, Ore
Sturtevant Mill Co.

Pumps, Acid-Proof
Amer. Machine & Fdry. Co.
Duriron Co.
Oliver Continuous Filter Co.
Resisto Pipe & Valve Co.

Pumps, Air Lift
Ingersoll-Rand Co.
Sullivan Machinery Co.

Pumps, Bilge, Brine, Circulating, Deep Well, Fire, Mine, Quarry, etc.
Devine Co., J. P.
Ingersoll-Rand Co.
Worthington Pump & Mchy. Co.

Pumps, Centrifugal
Duriron Co.
Ingersoll-Rand Co.
Krogh Pump & Machinery Co.
Moore Steam Turbine Corp.
Worthington Pump & Mchy. Corp'n.

Pumps, Rotary
American Machine & Fdy. Co.
Connerville Blower Co.
Ingersoll-Rand Co.
Roots Co., P. H. & F. M.

Pumps, Sand
Krogh Pump & Machy. Co.

Pumps, Steam
Dean Bros. Co.
Ingersoll-Rand Co.
Worthington Pump & Mchy. Corp'n.

Pumps, Vacuum
Buffalo Fdy. & Mach. Co.
Connersville Blower Co.
Dean Bros. Co.
Devine Co., J. P.
Ingersoll-Rand Co.
Oliver Continuous Filter Co.
Roots Co., P. H. & F. M.
Sullivan Machinery Co.
Worthington Pump & Mchy. Corp'n.

Pyrometer Protection Tubes
Bristol Co., The
Calorizing Co., The
Coors Porcelain Co.
McDanel Refractory Porcelain Co.

Pyrometers
Bristol Co., The
Hoskins Mfg. Co.
Shore Instrument Co.
Taylor Instrument Co.

Recorders, Barometric, Draft & Vacuum
Bristol Co., The

Recorders, Specific Gravity
Bailey Meter Co.

Recording Instruments
Amer. Schaeffer & Budenberg Mfg. Co.
Bailey Meter Co.
Bristol Co., The

Recuperators
Calorizing Co., The

Refined Silicon
Electro-Metallurgical Sales Corp'n

Refractories
Harbison-Walker Refractories Co.
Laveno & Co., E. J.

Regulators, Pressure and Temperature
Bristol Co.
Files Temperature Control Co.
General Electric Co.
Powers Regulator Co.
Taylor Instrument Co.

Resistance Material, Elec.
Driver-Harris Co.
Hoskins Mfg. Co.

Retorts, Graphite
Bartley Crucible Co., J.

Rhodium
Baker & Co.

Rubber Accelerators
Roessler & Hasslacher Chem. Co.

Screens, Inclined, Vibratory
Sturtevant Mill Co.

Screens, Wire, Brass, Copper, Steel
Cleveland Wire Cloth & Mfg. Co.
Ludlow-Saylor Wire Co.
Multi-Metal Co.
Simpson Co., The Orville
Tyler Co., W. S.

Second Hand Equipment
See Searchlight Section
Alberger Chem. Machy. Co.
Campbell, W. H., Inc.
Consolidated Products Co.
Lungwitz, Emil E.
Machinery & Equipment Co.
Mahan Co., H. B.
Miller, I.
Nashville Industrial Corp'n.
U. S. Food Products Corp.

Separators, Air
American Tool & Machine Co.
Dust Recovering & Conveying Co.
Kent Mill Co.
Raymond Bros. Impact Pulverizer Co.
Sturtevant Mill Co.

Separators, Centrifugal
American Tool & Mach. Co.
Fletcher Works
Tolhurst Machine Works

Separators, Incline, Vibrating Screens
Sturtevant Mill Co.

Sheets, Heat & Acid Resisting
Ohio Steel Foundry Co.

Sheets, Rods and Tubes, Brass & Bronze
Rome Brass & Copper Co.

Sheets, Roofing & Siding, Corrugated and Plain
Ryerson & Son, Jos. T.

Sifters, Centrifugal & Vibrating
Simpson Co., The Orville
Tolhurst Machine Works

Sodium Tungstate
Fansteel Products Co.

Solvent Recovery Equipment
Barnebey Cheney Engrg. Co.
Buffalo Fdy. & Machine Co.

Solvents, Inflammable & Non-flammable
Roessler & Hasslacher Chem. Co.

Spectrometers
Palo Co.

Spray Systems
Spray Eng. Co.

Spur & Worm Gear Speed Reducers
Philadelphia Gear Works
Terry Steam Turbine Co.

Steam Traps, Tilting Type
Morehead Mfg. Co.

Steel, Bars, Plates, Shapes & Sheets, Cold Rolled and Strip
Harrisburg Pipe & Pipe Bending Co.
Ryerson & Son, Jos. T.

Steel, Fabricated
Harrisburg Pipe & Pipe Bending Co.

Steel, Structural
Ryerson, Jos. T., & Son Co.

Stills, Vacuum
Pfaudler Co.

Stills, Water
Barnstead Still & Sterilizer Co.
Stokes, F. J., Machine Co.

Stirrers, Acid Proof
Duriron Co.

Stocks and Dies
Toledo Pipe Threading Machine Co.

Stokers
Babcock & Wilcox Co.
Combustion Engrg. Corp'n

Stoneware, Acid Proof Chemical (Consisting of Bottles, Carboy Stoppers, Coils and Worms Crystallizing Dishes, Decanting Pots, Dippers, Dipping Dishes, Faucets, Funnels, Kettles, Nozzles and Jets, Pots and Jars, Pipe Fittings, Pitchers, Retorts, Receivers or Woulff Bottles, Sinks Storage, Jars, Towers, etc.)
General Ceramics Co.
Knight, M. A.
U. S. Stoneware Co.

Sulphonators
Buffalo Fdy. & Machine Co.

Sulphur
Du Pont de Nemours & Co., Inc.
Union Sulphur Co., The

Superheaters
Babcock & Willcox Co.

Switchboards
General Electric Co.

Tachometers
Amer. Schaeffer & Budenberg Mfg. Co.

Tanks, Acid, Chemical, Oil, Pressure and Storage, Iron and Steel
Harrisburg Pipe & Pipe Bending Co.
Hauser-Stander Tank Co.
Koven & Bro., L. O.
Resisto Pipe & Valve Co.
Steere Engineering Co.

Tanks, Acid Proof, Stoneware
See Stoneware, Chem., etc.

Tanks, Enameled
Pfaudler Co.

Tanks, Lead Lined
Abernethy, J. F.
Hauser-Stander Tank Co.
Koven & Bro., L. O.
Resisto Pipe & Valve Co.

Tanks and Vats, Wood, Acid, Pickling & Plating
Hauser-Stander Tank Co.
National Tank & Pipe Co.
Pacific Tank & Pipe Co.

Tanks, Rubber-Lined
Hauser-Stander Tank Co.

Tanning Extracts
Industrial Chemical Co.

Tantalum Metal
Fansteel Products Co.

Testing Sieves & Testing Sieve Shakers
W. S. Tyler Co.

Thermometers, Recording & Indicating, Flue Gas, etc.
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Bailey Meter Co
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Tools, Ratchet, Pipe Threading
Toledo Pipe Threading Machine Co.

Towers and Accessories, Acid Proof, Stoneware
See Stoneware, Chem., etc.

Towers, Acid, Metal
Duriron Co.

Transformers
Allis-Chalmers Mfg. Co.
General Electric Co.

Traps, Air, Steam, Return & Non-Return
Morehead Mfg. Co.
Nicholson & Co., W. H.

Tubes, Condenser, Brass
Rome Brass & Copper Co.

Tungsten Metals
York Metal & Alloys Co.

Turbines, Steam
General Electric Co.
Moore Steam Turbine Co.

Turbo Blowers
See Blowers, Turbo

Uranium Alloys
Standard Alloys Co.

Valves, Air or Steam Operating
Nicholson & Co., W. H.
Powers Regulator Co.

Valves, Balance, Lever, Float Reducing, Pressure, Back Pressure
Merrill Co., The

Valves and Cocks, Stoneware, Acid Proof
See Stoneware, Chem., etc.

Valves & Fittings, Acid Proof Lined with Lead
Resisto Pipe & Valve Co.

Valves & Fittings, Metal, Acid-Proof
Duriron Co.
Hurt Engrg. Corp., Geo F.

Vanadium Alloys
Standard Alloys Co.

Varnishes
Du Pont de Nemours & Co., Inc.

Ventilating Apparatus
American Blower Co.
Dust Recovery & Conveying Co.
General Electric Co.
Sturtevant Co., B. F.

Vises, Pipe
Toledo Pipe Threading Machine Co.

Waterproofing Compounds
Celite Products Co.
Toch Bros.

Welding Materials
General Electric Co.

Whiting
Industrial Chemical Co.

Wire Cloth
Baker & Co.
Cleveland Wire Cloth Mfg. Co.
Ludlow-Saylor Wire Co.
Multi-Metal Co.
Ohio Steel Foundry Co.
Tyler Co., W. S.

Wire, Heat & Acid Resisting
General Electric Co.

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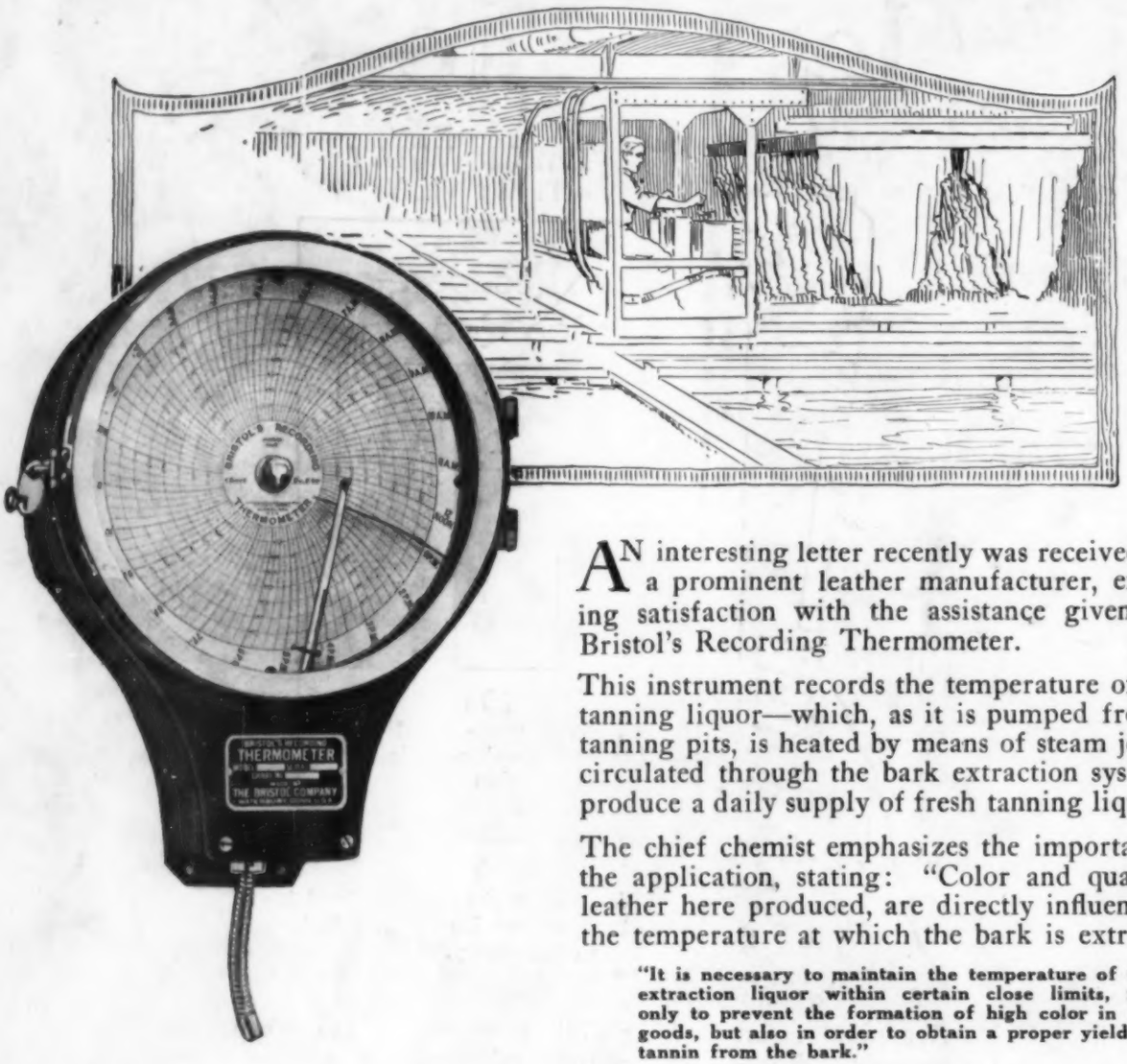
Controlling Leather Quality



AN interesting letter recently was received from a prominent leather manufacturer, expressing satisfaction with the assistance given by a Bristol's Recording Thermometer.

This instrument records the temperature of spent tanning liquor—which, as it is pumped from the tanning pits, is heated by means of steam jets and circulated through the bark extraction system, to produce a daily supply of fresh tanning liquor.

The chief chemist emphasizes the importance of the application, stating: "Color and quality of leather here produced, are directly influenced by the temperature at which the bark is extracted."

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Our Bulletin 1202-*B gives interesting data.*

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